April, 1946 Periodical Vol. 35, No. 4

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

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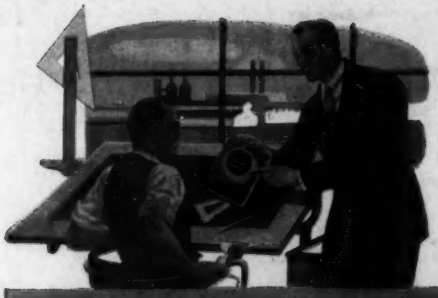
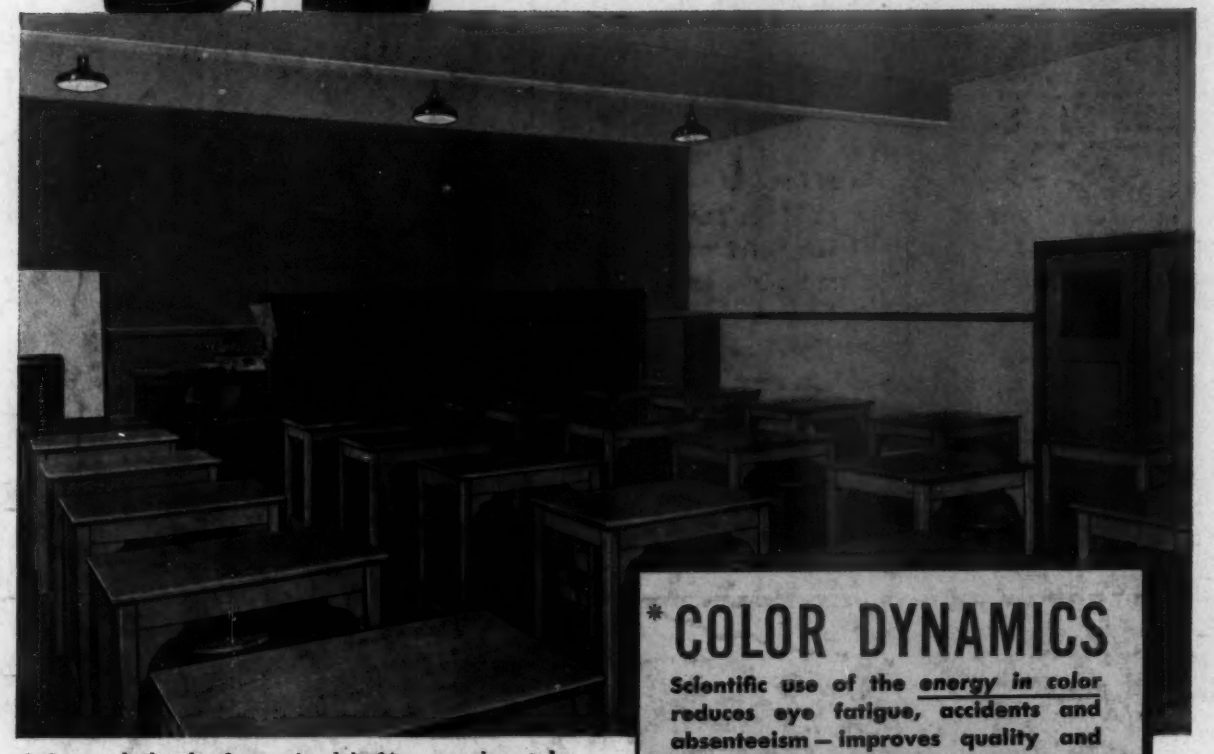
The Shop Teachers' Professional Magazine



Start Now To Teach Your Vocational Students COLOR DYNAMICS*



● *Suggested color plan for vocational drafting room, decorated according to the principles of COLOR DYNAMICS*

***COLOR DYNAMICS**

Scientific use of the *energy in color* reduces eye fatigue, accidents and absenteeism — improves quality and quantity of production!

HOW CAN A WORKER'S vision be improved so that tension and eye fatigue are lessened? How can the danger of accidents from mobile equipment and overhead conveyors be lessened? How can combinations of color improve working conditions and influence relationship between employees and management?

Industry is finding the answers to these and many similar questions in Pittsburgh's new science of COLOR DYNAMICS. For this new painting system is based upon the natural reactions of normal human beings to the *energy in color.*

Production executives are discovering by experience that color, properly "engineered" on a machine, on walls, ceilings and on floors, has a marked influence on the health, morale and skill of workers.

By using colors on operating parts of a machine which contrast with the materials being fabricated, the work is easier to see. Receding colors on the stationary parts of the machine and on walls provide eye-rest periods. Color symbols readily identify danger areas.

Labor and management benefit by such purposeful use of color. Continuity of employment is promoted. Efficiency of operation is improved, quality and quantity of production maintained!

That's why many educators in vocational schools now include COLOR DYNAMICS in their courses, giving students first-hand knowledge of a subject of great importance in their future work. A good way to teach COLOR DYNAMICS is to paint a machine or two, walls, floors and ceilings in your school shop!

Write today for a free copy of our book, *"COLOR DYNAMICS for Industry."* It makes an excellent text book. Pittsburgh Plate Glass Co., Dept. IV-4, Pittsburgh 22, Pennsylvania.

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RE-TRAINING RETURNED VETERANS

SENECA VOCATIONAL HIGH SCHOOL
MACHINE SHOP, BUFFALO, NEW YORK

"MODERN SCHOOL SHOPS"

This booklet contains many illustrations of excellent installations in school shops, both large and small. If you are interested in modern school shops and the machinery with which they are equipped, you'll want a copy. Mailed free to shop instructors and supervisors on request. Write for your copy today!

Vocational schools today face the big job of re-training discharged servicemen—veterans who need intensive, expert instruction to bring them up-to-date in skills developed to new peaks during the war.

Modern training for industry demands modern equipment. Trainees learn more, faster, with tools that have kept pace with the latest technical developments. Obsolete equipment is just as inefficient in the school shop as it is in the industrial plant.

The same qualities which make South Bend Lathes so useful in industry emphasize their value to the well-equipped vocational school. Extreme accuracy and unfailing dependability, combined with ease of operation and wide versatility, insure satisfaction. Many school shops are making complete new installations.

Made in five sizes ranging from 9-inch swing to 16-inch swing, the full line of South Bend Precision Lathes is described and illustrated in Catalog 100-D. Write today for your free copy.

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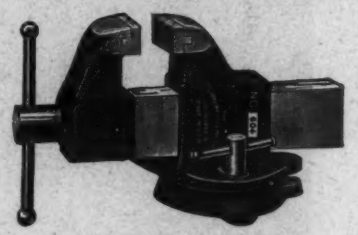

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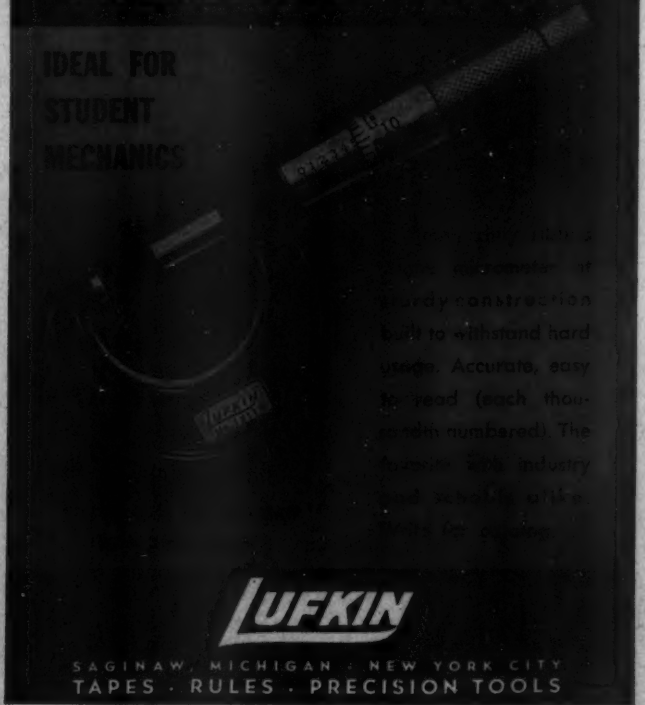

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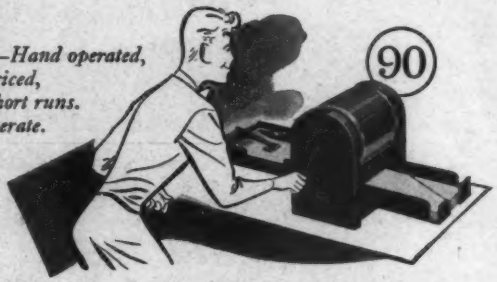

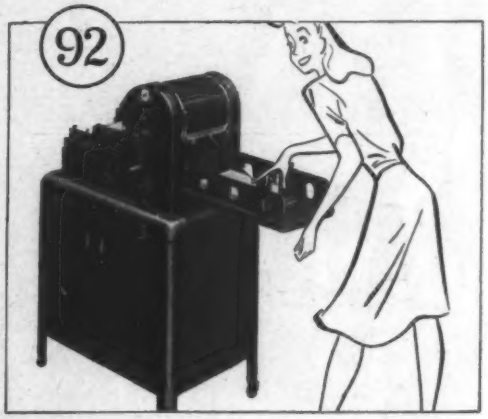

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Model 539 Current Transformer has four self-contained primary ranges of 2-5-10-20 amperes selected through a switch; with higher ranges by passing conductor through transformer. Has short circuiting switch for damage prevention.

While relatively low in cost, these instruments provide the precision and dependability necessary to teach students habits of exactness. Their ruggedness, too, makes them ideal for student use. Literature sent on request.

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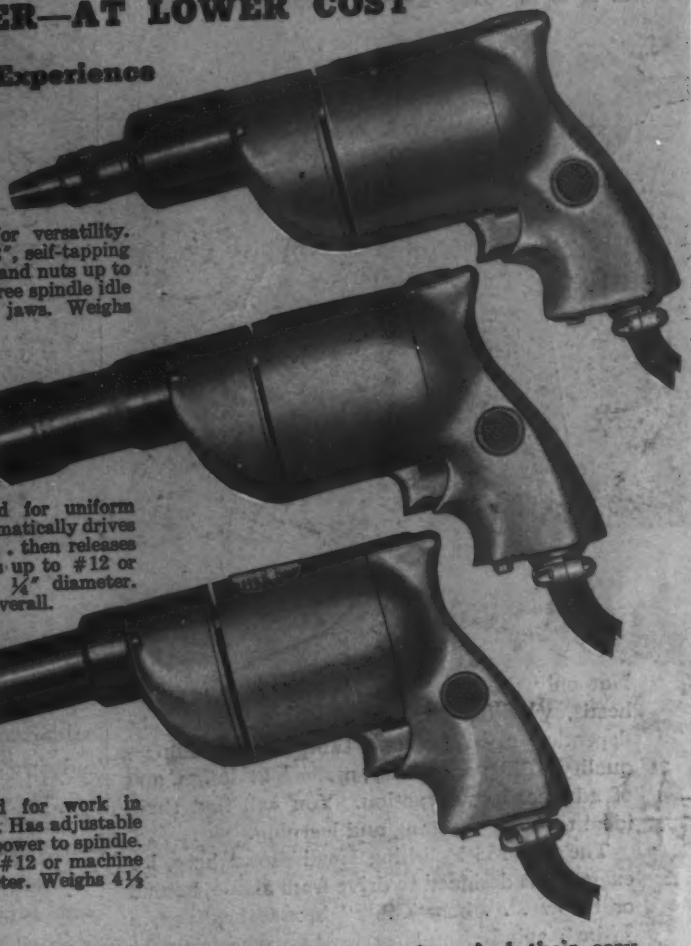

Positive Clutch Screwgun—Designed for versatility. Drives wood screws up to #10 x 2", self-tapping screws up to #12, machine screws and nuts up to ¼" diameter. Positive clutch lets free spindle idle until operating pressure engages jaws. Weighs 3½ lbs. Measures 8¾" overall.

Adjustable Clutch Screwgun—Designed for uniform production. Adjustable clutch automatically drives every screw to uniform tension . . . then releases spindle. Drives self-tapping screws up to #12 or machine screws and nuts up to ¼" diameter. Weighs 3¾ lbs. Measures 10¼" overall.

90° Angle Drive Screwgun—Designed for work in close quarters and around corners. Has adjustable clutch. Angle head transmits full power to spindle. Drives self-tapping screws up to #12 or machine screws and nuts up to ¼" diameter. Weighs 4½ lbs. Measures 10¾" overall.

Light . . . compact . . . easy to use . . . Black & Decker Screw Drivers and Nut Runners come in models to fit every type of assembling job . . . from the most delicate screw driving operations to driving and tightening nuts and bolts up to 1" diameter, or lag screws up to ¾" by 6".

Driven by powerful Universal motors, they'll help train your students in the high-speed techniques used in industry . . . train them, too, in turning out accurate, uniform work that will pass inspection. And their easy operation will minimize the beginner's hesitancy . . . keep your training on schedule by making learning easier.

Three of these cost-cutting assembly tools are shown here . . . and full information about all models and their many applications is given in our 60-page, illustrated "Power Assembly Tool Data Book." For a copy, address: The Black & Decker Mfg. Co., 680 Pennsylvania Ave., Towson 4, Md.

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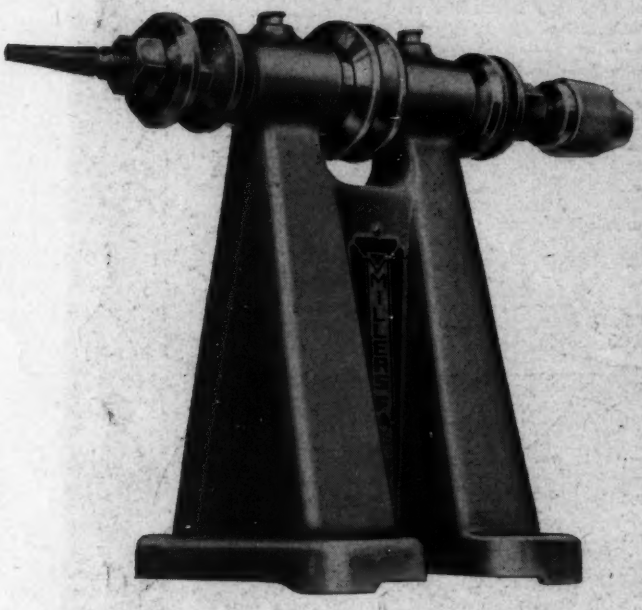

Not only the one above, but *all* Millers Falls' heads, whether grinding or polishing, can be depended upon for one thing in common — quality. They are sturdy, modern in design, and of advanced construction. You will find them ideal tools for teaching and learning.

The No. 155 Polishing Head shown here, for example, is designed to drive from above, behind or below . . . has "Oilite" bronze bearings, a ¾-inch spindle, and carries two wheels up to seven inches in diameter, a ⅜-inch capacity chuck and a taper thread spindle . . . bearings are lubricated through good-sized spring top-oilers.

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MILLERS FALLS TOOLS SINCE 1868

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GREENFIELD, MASSACHUSETTS

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Photo courtesy of Bell Aircraft Corporation showing how wires are soldered to electrical switch, held in special jig.

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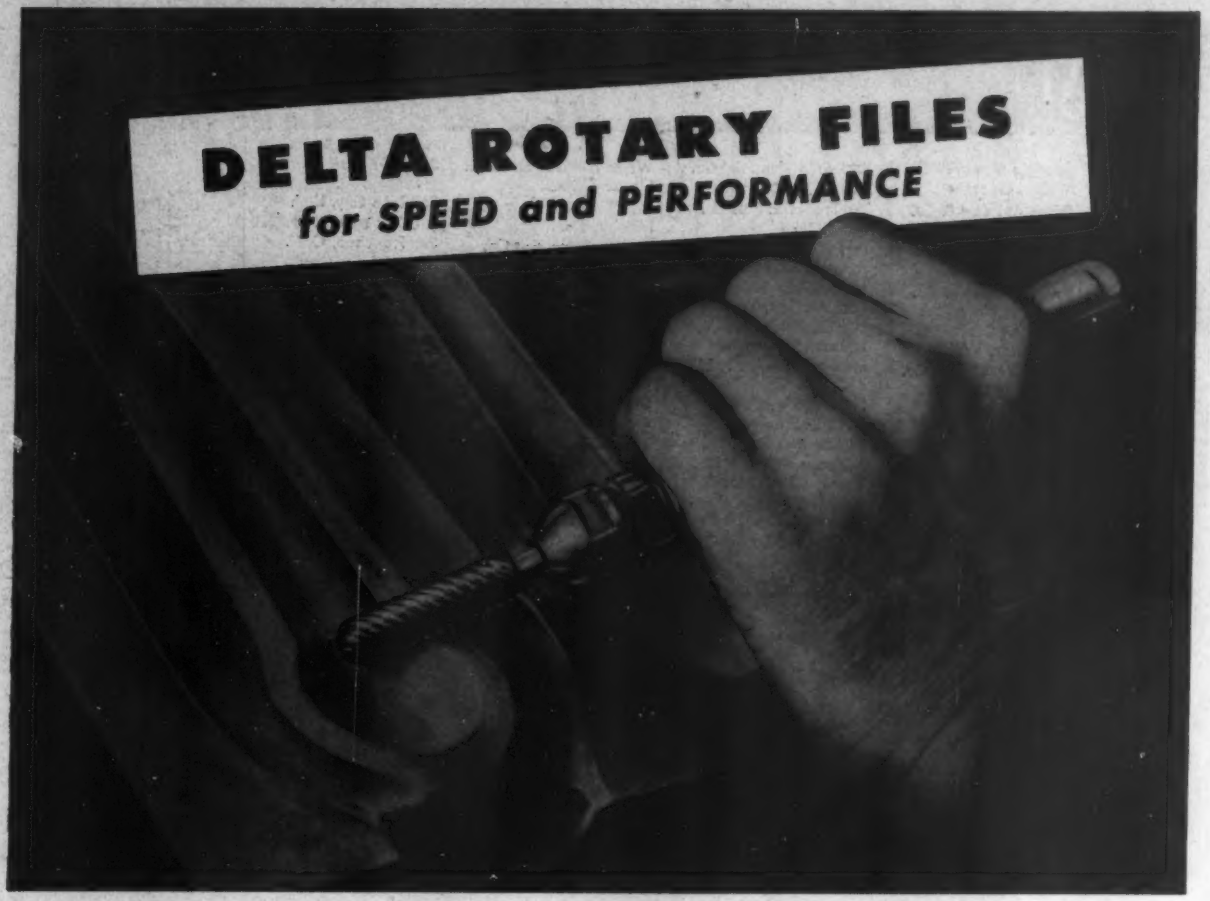

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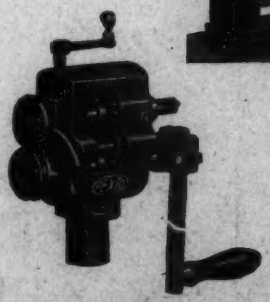
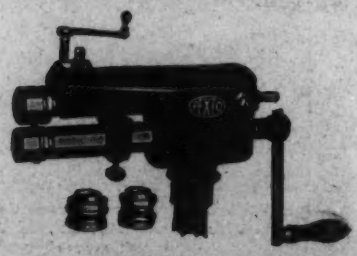


ROTARY MACHINES

FORMING MACHINES



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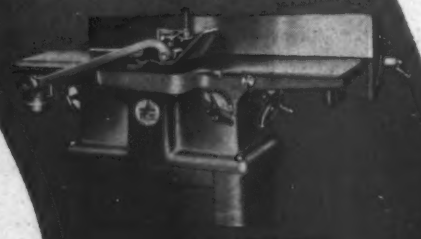

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The exceptionally wide range of cutting speeds of Walker-Turner Machine Tools fits them for an unlimited variety of projects. Simplified design insures easy, safe operation—enables students to concentrate on the project rather than the machine. Rugged construction makes them ideal for inexperienced operators. And Walker-Turner Machine Tools give thorough *industrial* training *at prices kept low* through thoughtful design, careful selection of materials, and assembly line production methods.

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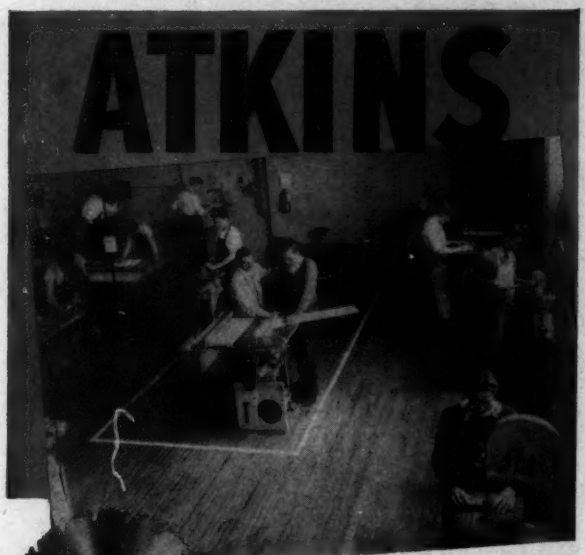

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comes from
LEARNING HOW
with the right tools

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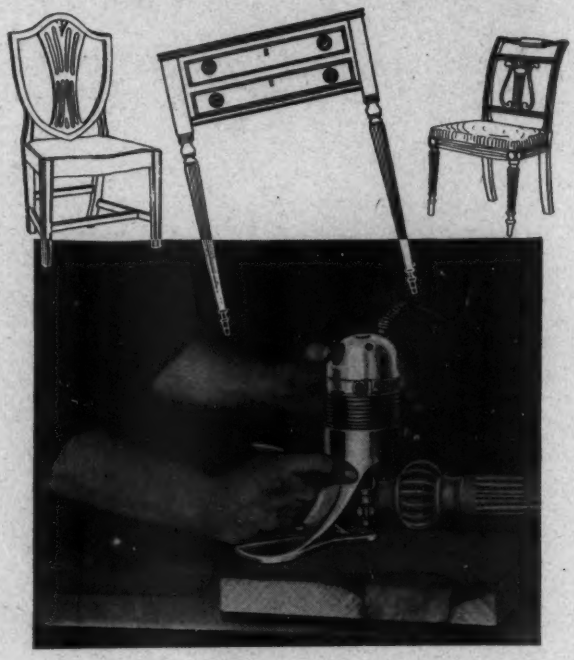

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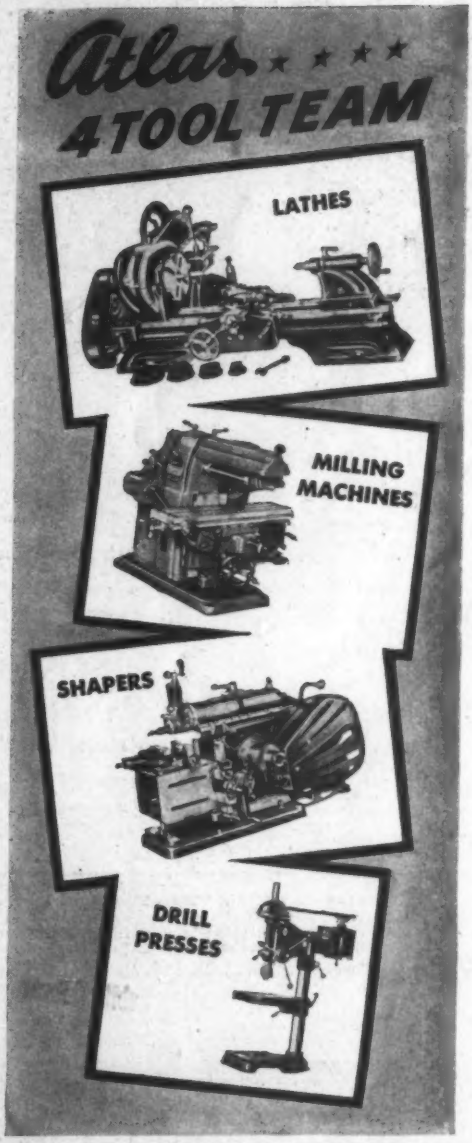

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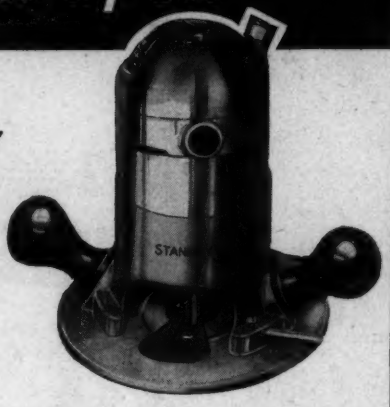

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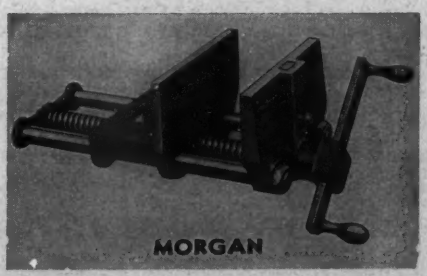

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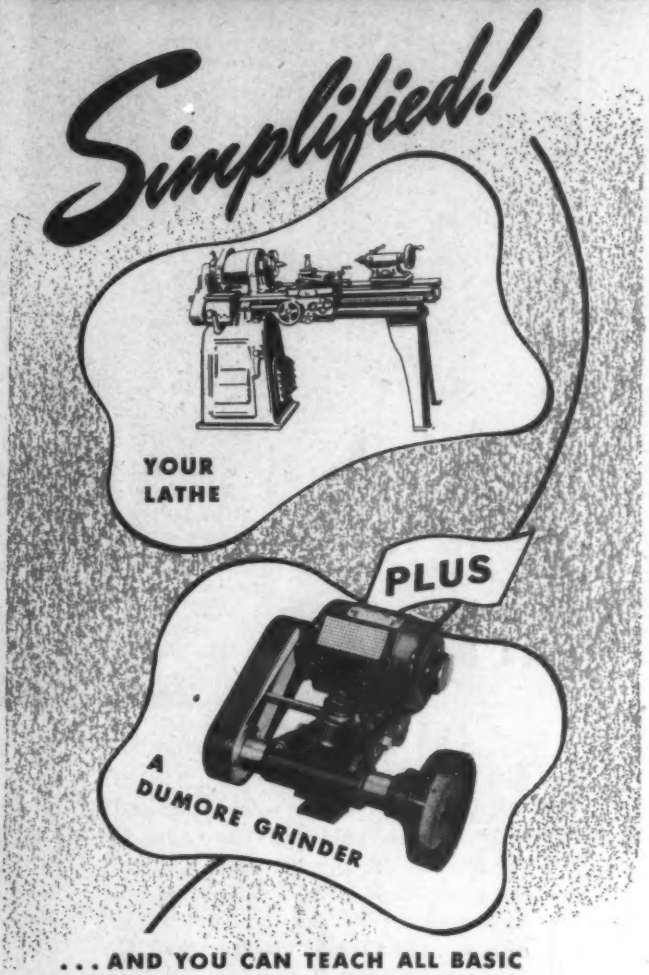

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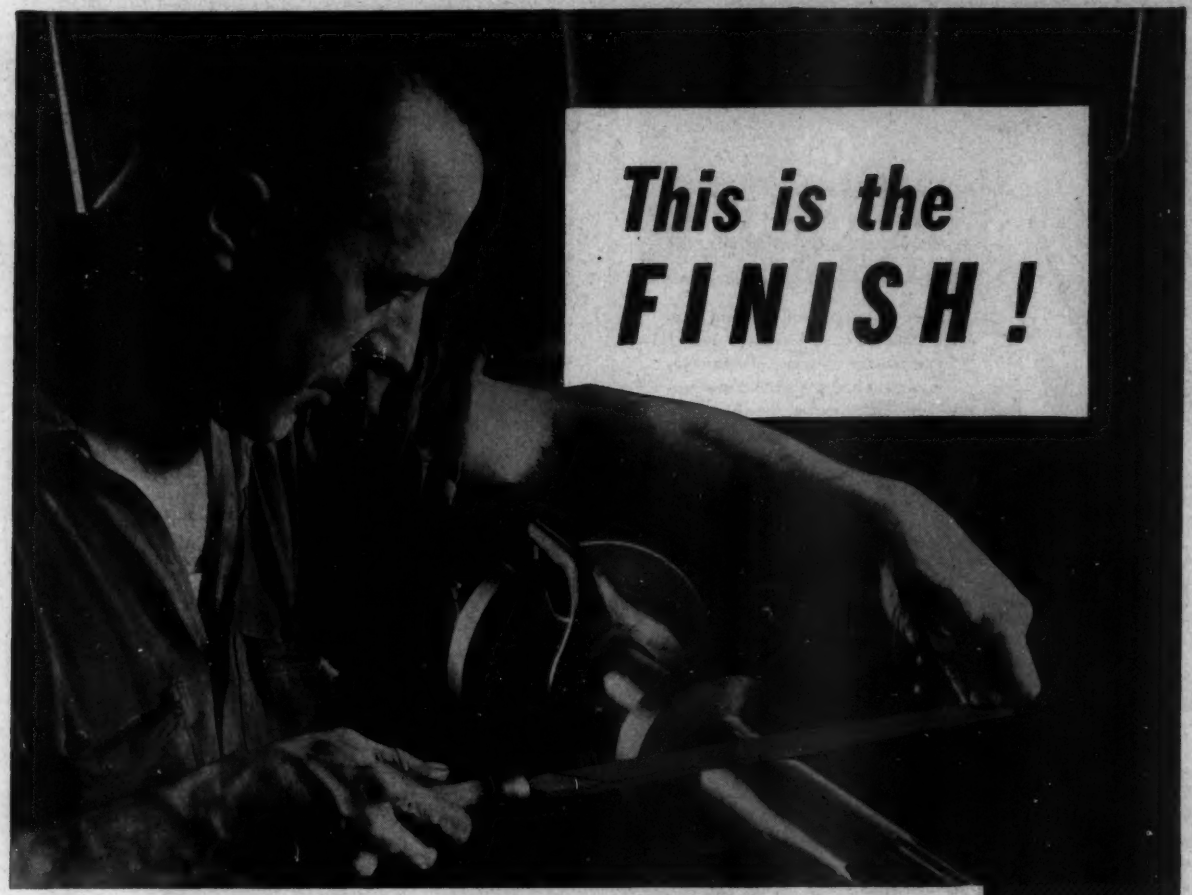

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It may be time to think about attending summer school, even though the vacation season will not be here for several months. Now that our country is no longer required to exert every effort to equip itself and all of its allies with the implements of warfare, teachers can again look forward to spending part of their vacation time in an effort to better themselves professionally and at the same time to meet old classmates and other teachers under friendly and happy circumstances, on the beautiful campus of some chosen university, beneath pleasant summer skies.

This issue carries the advertisements of several such summer school opportunities, but to make it easier for the reader to get an overview of what they offer a brief résumé is here given.

Bradley Polytechnic Institute, Peoria 5, Ill., offers undergraduate and graduate courses for teachers in their 1946 summer session, which opens June 17 for two 30-day terms.

The Pennsylvania State College, Room 301 Burrowes Bldg., State College, Pa., offers graduate and undergraduate courses for teachers in an intersession from June 10 to June 29, and a main session from July 1 to August 10.

The Stout Institute, Menomonie, Wis., offers three-week and six-week courses for graduate and undergraduate study in its summer session beginning June 17 and ending August 16.

This Month's Cover

The picture chosen for the cover of the April issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION presents a mechanic grinding the bore in a large sleeve gear on a 14 by 72-in. hydraulic universal milling machine. To make this machine as adaptable as possible, the workman is supplied with a number of quills, spindles, and wheels of different sizes so that bores of various sizes may be ground. Photograph, courtesy of Cincinnati Grinders, Inc., Cincinnati, Ohio.

Industrial Arts and Vocational Education

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TABLE OF CONTENTS

Industrial Education in the Years Ahead, *H. H. London* and *Ivan Hostetler* ... 147
Brief History of Industrial Arts and Vocational Education, *Erhard F. Wendt* .. 151
Seeing in the Schoolhouse, *William G. Darley* 154
Techniques Used in Teaching Machine-Shop Operations to the Blind, *Robert S. Hunter* 158
My Kind of Boy, *Leonard E. Schmidt* 161
Production Orders for the Vocational Shop, *Milo P. Johnson* 162
Designing Industrial Arts and Vocational Education Shops and Classrooms, *H. W. Paine* 163
Offset Lithography — Opportunity for Special Aptitudes, *Henry C. Latimer* ... 164
Editorials 165
Preparation for a Changing Vocational World, *Earl M. Bowler* 166
Co-operative Education Needs Publicity, *Donald K. Beckley* 167

Problems and Projects

Using the Milling Machine As a Surface Grinder, *Hartingh W. Babcock* 168
A Tailstock-Spindle Stop, *Morris Adler* 169
Low Speed Demonstration Motor, *Joseph J. Lukowitz* 169
Introducing a Course in Art-Metal Work, *Carlyle H. Smith* 172
Ornamental Tin Craft, *Chris H. Groneman* 172
Course of Study for First-Year Industrial-Arts Machine Shop, *Robert L. Mohle* 173
General Operations in the Working of Plexiglas, *Lauton Edwards* 173
Electric Basketball Scoreboard, *Wm. Costellano* 177
Three-Step Tie Rack, *Isadore M. Fenn* 179
Midget Express Wagon, *Donald L. Detwiler, Lloyd B. Kehler,* and *P. W. Memmert* 179
Toolmakers' Buttons, *Robert L. Mohle* 181
Photoengraving in the School Shop, *Edward T. DeVoe* 181
Timesaver for the Printing Teacher, *B. H. Thomas* 183
Animal Glue — Chemically Speaking ClO_2 H_{151} O_{39} N_{31} 183
Wall Plaque, *Edward S. Haas* 183
Keep Up the School Savings Plan 185
Welding Cracked Cylinder Blocks 185
Pictorial Assembly Drawings, *D. C. Black* 186
Self-Evaluation Check List for Shop Teachers, *Joseph A. Schad* 188
Poster Easel, *Charles F. Zaenglein* 190
The All-American Soap Box Derby Is Back 190

Personal News 18A
Association News 23A
News Notes 26A
New Publications 31A
Shop Equipment News 32A

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Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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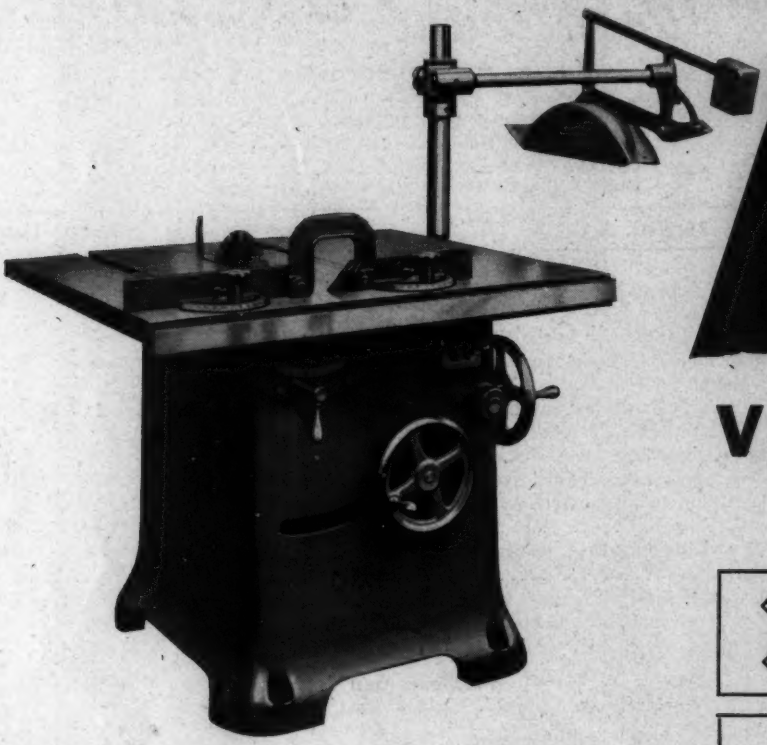

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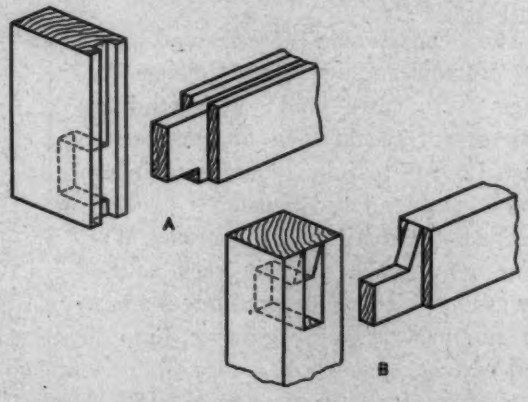

MORTISE-AND-TENON JOINT

The haunched mortise-and-tenon joint (A) is generally used when a panel is to be built into a frame. Since both pieces are grooved their full length, the haunch provides lateral stiffness and prevents light from showing through the joint. The table (or taper) haunched joint (B) is a modified form which is used to join the rails to the legs of tables. It is somewhat more attractive in appearance.

Industrial Education in the Years Ahead

H. H. London and Ivan Hostetler***

Before the war our programs of industrial arts and vocational-industrial education were running along fairly well, although they had many shortcomings and met only a small portion of the need for this type of education. When the war came, schools were called upon to convert their shop programs to war purposes. What they did in providing preinduction and war-production training is common knowledge. The bulk of the training offered during this period was rather narrow and highly specialized, the emphasis being placed upon production rather than the welfare of the trainee. Many shop programs were upset completely, some were closed for lack of teachers, and they all had their "headaches" over supplies and equipment.

But now that the war is over and we are undoubtedly moving into a new era of technical and industrial development, we must turn our attention to the future. Workers in the field and other interested persons must ask themselves the question: "What type of industrial education program should the public schools offer in the years ahead?" Then they should think the question through in terms of present and future needs and in light of what we have learned in the past, arriving at a program that is consistent with the facts and defensible. If the things we have been doing are still sound, then we should continue them; if they are not, we should change them.

In the end, an educational program is good or bad, desirable or undesirable, in terms of the interpretation which the supporting public, the people, place on that program. Their interpretation, in turn, depends upon their philosophies or points of view. These philosophies and points of view come to the surface through expressions of opinion. As we have learned in recent years through national opinion polls and research studies, opinions can be measured with a surprising degree of accuracy, and these measurements used to predict the outcomes of future social action.

A nationwide study of opinions of leaders of labor, management and education on current issues in industrial education was recently completed at the University of Missouri,[1] the assumption being that a composite of these opinions would give some indication of the type of industrial education programs which the schools should offer in the years ahead. Definite opinions concerning these issues were given by approximately 900 leaders of these groups from the 48 states and the District of Columbia. Space does not permit a complete listing of all the issues and a statistical summary of results,[2] but the chief findings of the study, together with typical comments, follow.

*Associate Professor, Industrial Education, University of Missouri, Columbia, Mo.

**Chairman, Division of Fine and Applied Arts, Georgia Teachers College, Collegeboro, Ga.

[1]Hostetler, Ivan, *An Analysis of Opinions on Industrial Education With Their Implications for a Program in the Public Schools*, Unpublished Doctor's Dissertation, University of Missouri, 1945.

Objectives and Needs

1. The need for industrial education in the postwar period will exceed that of the prewar period. The program, however, should be broader and richer, including more activities and reaching more people. It should keep pace with developments in industry and the needs of the labor market area.

The need has always been great but not recognized. — *Official, Oil Workers Union.*

The tremendous accumulation of new facts and procedures demand a vast extension of industrial education in the public schools.— *Vice-President, Aviation Corp.*

Perhaps not greater, but will be more readily accepted by us. Vocational education in my system has been widely accepted by the people for the other fellow's children. — *Superintendent from the South.*

2. Both industrial arts and vocational-industrial education are needed in the public schools. Neither the one nor the other is adequate by itself. The two should supplement each other.

This is absolutely necessary so that our people may be prepared for a definite job, and will be able to find out which type of job they are best qualified to perform. — *Official, United Steel Workers of America.*

Any well balanced curriculum should include both, in order to meet the needs of various students. — *Supervisor of Training, Stove Company.*

Vocational-industrial education has a specific job of training to do and industrial arts is a necessary prerequisite. — *State Supervisor.*

3. In the interest of national security, the public schools should provide basic industrial education (general training in the care and use of common tools, materials, and machines) for a large group, from which specialists can be developed quickly in case of emergency.

This is one lesson that I hope our country will not forget soon. — *President, Industrial Union Council.*

[2]A 12-page statistical summary of the study may be secured by writing to the Department of Industrial Education, University of Missouri, Columbia, Mo.

General, all-round, basic industrial education should be the aim. Specialization should be avoided. — *Regional Director, C.I.O.*

If we fail to do this, they will fail the nation in war or peace. — *Training Director, Farm Machinery Company.*

Basic industrial education should be provided for all, on which national security must rest. — *Local Director.*

4. Before adequate industrial education can be available to all youth and adults who need this training, many of the smaller schools must be consolidated into larger administrative units. In communities where this is not possible, provision should be made for industrial education, even at the expense of reducing offerings in the traditional subjects.

Sufficient funds should be provided for both. — *President, National Association, A. F. of L.*

There are some traditional subjects that could be reduced in favor of industrial education. — *President, State Industrial Union Council.*

We have been educating too much for college rather than for life and have forgotten about terminal education for high school youth. — *Employment Manager, Road Machinery Company.*

Let's limit offerings like Latin and classical literature to those who can really profit. — *Superintendent.*

We can do both well by proper organization. — *Superintendent.*

5. Vocational technical training (training for occupations above the skilled trades and below the engineering level) should receive more emphasis in the public schools. This means more attention to shopwork and to applied mathematics, science, drawing, measurement, testing, and the like. Where this training cannot be adequately given in the general high school, technical high schools, or technical institutes should be established. This training should be provided on both pre-employment and supplementary levels, and should be open to all interested individuals of proved ability and aptitude.

Schools can make a very valuable contribution on this point. — *Official, State Branch, A. F. of L.*

There is a growing need in industry for an educational program which will fit individuals to fill jobs which are some place between the requirements of high school graduates and graduate engineers. — *Personnel Director, Glass Manufacturing Company.*

Public education in any form should be available to anyone if they can profit by training. — *Superintendent.*

6. The public schools should provide vocational-industrial education for both

skilled workers and semiskilled workers or operators. However, greater emphasis should be placed on the training of workers for the skilled trades.

Not "either-or," but both; the training of the middle group is actually (our) greatest failure. — *Regional Director, C.I.O.*

Shortage always in skilled workers. Train for top, not for bottom. — *Vice-President, Piano Manufacturing Company.*

Since both are needed, neither should be emphasized to the exclusion of the other. — *Vice-President, Machinery Manufacturing Company.*

Industry will train its own operators on the job regardless of what industrial education gives them. — *Teacher Trainer.*

7. The industrial education program in the secondary and evening schools should provide opportunities in home mechanics, home maintenance, and home planning for youth and adults. This is a service especially needed in the years immediately ahead.

Many citizens would take advantage of such courses and would profit greatly by taking them. — *State Union Leader.*

This is sadly lacking — would be a fine thing. — *President, Appliance Manufacturing Company.*

(Agree) most heartily. Such courses, with capable teachers, would perform a real public service and fill a genuine need. — *Local Director, New Jersey.*

Particularly effective in evening schools for adults. — *Wisconsin Superintendent.*

8. Because of its importance in industry and for consumer purposes, all students should have an opportunity to learn to read blueprints and to make simple working drawings. Such training may be given along with shopwork or in special drawing courses.

Its importance should be stressed for all students. — *Educational Director, C.I.O.*

It would be more cultural than Greek in this day and age. — *Manager, Industrial Relations, Battery Company.*

Desirable for *all students*, but should not be required of *all*. — *Local Director.*

9. A considerable majority of leaders of labor, management, and education are of the opinion that youth who have had training in industrial education are better prepared for employment in industry than those who have pursued only academic courses. And over half of our wage earners are engaged in industrial occupations. Schools, therefore, should provide training programs which combine general with vocational education in those industries in which their students will find employment, and they should encourage those likely to enter industry to enroll in these programs.

These students . . . have learned shop practice which is very valuable. — *Regional Director, C.I.O.*

It appears that in general, for our type of organization, graduates who have had the general high school program, with exposures in what you define as general industrial education are more flexible and productive. — *Personnel Director, Communication Company.*

Assuming equal intelligence and ability (is a boy with a general high school education a better apprentice prospect than a trade school graduate), the answer is no. — *Manager, Construction Company.*

The war has proved this fact without a doubt (graduates of trade and vocational schools adapt themselves more readily to industrial employment than do graduates of general high schools). — *Georgia Superintendent.*

10. Junior colleges should provide a broad program of industrial education which will prepare high school graduates for employment in industrial occupations. Where the need exists a post high school program of vocational-industrial education should be provided for out-of-school youth who are below employable age. However, students enrolled in this program should not be paid while learning a trade.

This is the best place for such a program. — *State Director, C.I.O.*

Such a plan would help solve our juvenile delinquency problem. — *Regional Director, C.I.O.*

This is a problem for cities and not the federal government. — *President, Manufacturing Corporation.*

No (students should not be paid while learning a trade), let the student learn that he must earn his living. — *Director, Industrial Relations, Aircraft Corporation.*

This (public school program for out-of-school youth) should replace any N. Y. A. plans, federally aided. — *Illinois Superintendent.*

11. The schools should provide a vocational-industrial education program for retraining persons unemployed due to technological changes. Such persons, however, should not be paid by the schools while they are training. Wages should be paid only for productive work, not for taking training. This does not preclude the payment of unemployment compensation to the temporarily unemployed.

O.K. for training (but) the public schools should not be commercialized. — *Secretary-Treasurer, State Branch A. F. of L.*

State unemployment benefits can take care of the pay problem. — Director of Personnel, *Engineering Works.*

Schools (should) train. Industry produces for sale. — *Personnel Supervisor, Shoe Company.*

Retraining could be made a requirement for those receiving unemployment compensation. — *Local Director, Vocational Education.*

Content and Nature of Program

12. In general, schools should key their *pre-employment* industrial education programs to job families rather than to specific jobs. That is, they should provide broad, basic, and fundamental pre-employment training in major industrial areas, training designed to equip the student with a wide range of marketable skills, to make him more apt as a beginning worker, and to enable him to adapt himself more readily to industrial changes. This follows because of the multitude of jobs in industry and because of the fact that a majority of these jobs require very little, if any, specialized pre-employment training. In the relatively few occupations for which specific pre-employment training can be justified, it should be given after age 16 or just prior to employment, and it should be preceded by general industrial education.

There is time for specialization later. None can foresee the industrial need in specific categories. — *President, C.I.O. Council.*

Never (give specialized training) before age 16, preferably after employment. — *Official, Machinist Union.*

Technological changes require broad, basic training. — *Director, Industrial Relations, Aircraft Corporation.*

Let training for specific jobs come later when student has developed a learning based on some educational and practical experience. — *President, Vise Company.*

I firmly believe in the broad, basic, or foundation training. — *Teacher Trainer.*

Scientific development has been and will be so rapid that pupils should be trained in a family of skills so as to more readily adjust themselves if a change of jobs is necessary. — *Rhode Island Superintendent.*

13. There are a number of jobs which are peculiar to certain industries and for which specific training should not be given by the schools. On the other hand, there may be a number of occupations in a community for which specific training can best be given by the schools. In any event, specific job training can ordinarily best be given on an *in-service* basis. This principle is recognized in both co-operative and apprenticeship training, through which the student learns the practical skills of his trade on the job and the related material in the school. In all cases specific job training calls for close co-operation between industry, labor, and education.

Some jobs such as carpenter, welder, woodworking, etc., can be trained in the schools. — *President, State Council, C.I.O.*

Surrender program to industry and "sweat shops" will follow. — *Official, National Association, A. F. of L.*

Doubt if it (specific training by schools) should be done at all. — *Director, Industrial Relations, Aircraft Corporation.*

To a large extent for many specific jobs, industry alone can do it. — *University Dean.*

Narrow training given by industry alone tends to exploit the individual and prepare him for only one employer. — *Local Supervisor, Illinois.*

14. Although the short, intensive industrial education courses given in public schools for war-production purposes proved successful as a war service, long-term courses are in general more desirable for peacetime training. Yet, there are some peacetime training needs which may best be met by short, intensive courses. In all training programs, however, primary consideration should be given to the welfare of the individual rather than to production.

Would be excellent for students of limited means to educate themselves quickly — *Official, State Industrial Union Council.*

Pupils need broader and more comprehensive training. — *Director of Education, Local Union.*

Served useful purpose in place, but in general industry can and should do this type of training as an in-plant program. — *Director, Industrial Relations, Aircraft Corporation.*

In some cases yes, but in general I think the courses must be broader in scope. — *College President.*

15. Large high schools should provide industrial-arts experiences through a series of shops rather than limited training in only one shop. Smaller high schools should provide this type of training through the composite general shop in which a variety of tools, materials, and processes are involved. Regularly scheduled industrial-arts courses should begin in grades 7–9 and continue through grade 12, becoming more technical in the advanced grades.

The general shop organization should be used only if the schools are too poor to afford a series of shops. — *Educational Director, C.I.O.*

The more general (the training) the better. — *Manager, Furniture Factory.*

As far as practicable (training in a series of activities) this should be augmented by inspection trips to as many industrial plants and offices as possible. Get a broad view. — *Director of Training, Farm Machinery Company.*

Industrial arts should be a part of all education. — *Minnesota Superintendent.*

This is the only way effectively to meet the objectives of an adequate industrial arts program. — *California Superintendent.*

16. While industrial-arts experiences can be justified for nonvocational purposes for all youth, the industrial education program in the *full-time general high school* should not necessarily be confined to this type of training. In communities where there are no separate trade or vocational schools, it may be desirable to provide vocational-industrial classes in the general high school to meet the needs of the community for this type of training.

There is no reason why the full-time general high school should include only industrial arts in a program of industrial education. A good general high school would include vocational-industrial education. This arrangement avoids separating the future industrial worker from other citizens during the adolescent years. — *National Representative A. F. of L.*

I see *no reason* in *many* cases to make a segregation. General and vocational education *can* be operated under one roof at the secondary level. The tendency for some vocational education people to think of vocational education as something apart is erroneous thinking. — *Official, U. S. Chamber of Commerce.*

Vocational education should be integrated with the entire school program. The general high school should gradually assume a share of the load as vocational enrollments increase. — *Ohio Superintendent.*

17. Schools, especially smaller ones, should develop more co-operative part-time diversified occupations programs. These should be offered in grades 11 and 12 or on a post high school level, and through them the students should receive practical training on the job and related instruction in the schools. Such programs cost less to operate, and they permit training in a multitude of jobs not otherwise reached. In all cases they should be operated in accordance with policies established jointly by bona fide representatives of labor, management, and the schools. The student should receive high school credit for training on the job, as well as in the school, and also a monetary wage for productive work equal to that paid other beginning workers in the labor market area.

Yes (have co-operative programs), if the employers do not use this means of getting cheap labor or for beating down wage rates. — *Educational Director, Local Union.*

The co-operative plan is realistic and effective. — *Vice-President, Aviation Company.*

Our experience (with co-operative education) has been very satisfactory but believe it should be limited to twelfth, thirteenth, and fourteenth grades. — *Treasurer, Manufacturing Company.*

(The diversified occupations program is) Peculiarly adapted to small communities, but useful in large cities, scattered in the high schools. — *Teacher Trainer.*

This plan (diversified occupations) will work. I have tried it. — *Georgia Superintendent.*

Best guidance and training arrangement we have (diversified occupations). — *Teacher Trainer.*

After twenty-five years' experience in the co-op plan, I still rate it very highly. — *Michigan Local Director.*

Organization and Administration

18. All students should be encouraged to take one or more courses in industrial arts on an elective basis as a part of their general education. Such courses should be designed to interpret the world of industry, to develop handyman interest and abilities, consumer knowledge and appreciation, and to provide exploratory experiences leading to the choice of an occupation.

Should be open to all, but not forced on any. — *Educational Director, C.I.O.*

Otherwise, students may graduate overschooled and under-educated. — *Regional Official, A. F. of L.*

Train the hands to help the brains. — *Manager, Machine Tool Manufacturing Company.*

Industrial arts offers unusual opportunities to develop desirable traits, habits, skills and points of view which can not be effectively developed in a more formal subject matter program. — *California Superintendent.*

19. If programs of industrial education are to be effective, they must be preceded and accompanied by a realistic program of vocational guidance that takes into consideration, on the one hand, the assets and liabilities of the individual and on the other hand, the opportunities and requirements of the job for which training is to be given. To train individuals who lack ability or aptitude for jobs or to train people of ability for jobs in which there are no opportunities for employment, is definitely an unwise and wasteful practice. The idea that the school shop is designed solely to take care of the needs of students of low ability and that students of superior ability should not take industrial education must give way to a program of guidance which will enroll students in these courses on the basis of aptitude, interest, and need.

It is far more important that programs of guidance precede programs of industrial education rather than merely accompanying them. — *National Leader, A. F. of L.*

This is the key to the whole program. — *Treasurer, Manufacturing Company.*

If you provide *intelligent* vocational guidance. — *Assistant to President, Machine Manufacturer.*

I feel that guidance is most essential. — *University Dean.*

This is of utmost importance. — *Teacher Trainer.*

20. The student of proved ability and aptitude and who is willing to apply himself should be permitted to pursue courses in vocational-industrial education until he can secure a job, hold it, and make satisfactory progress in it. Conversely, those who cannot profit by the training should be dropped as soon as they have demonstrated their inaptitude for the work.

Yes, if vocational training is entered into after aptitude tests have demonstrated that the trainee is fit for such training. — *Director of Education, Local C.I.O.*

Not unless student shows adaptability. — *President, Tool Corporation.*

There is a limit somewhere. Aptitude tests could determine when to give up. — *Vice-President, Steel Company.*

Less than this is wasteful. — *Teacher Trainer.*

21. Individuals should be permitted to enroll in industrial evening schools and classes in which they are interested regardless of whether or not such courses are supplementary to their daily employment. To help the individual find, prepare for, and enter the job for which he is best fitted and in which he can do his best work should be ranked along with occupational upgrading as an objective of the evening industrial school. In administering these programs, however, it should be observed that the Smith-Hughes Act does not permit such classes to be reimbursed from federal funds. The law should be changed.

Very decidedly. Freedom of choice in education should be unrestricted. — *Secretary-Treasurer, State Branch, A. F. of L.*

Any individual not satisfied with his present work should be given the opportunity to train for some other work. — *President, State Central Labor Council, A. F. of L.*

An opportunity is thereby provided to correct misapplication of ability. — *Vice-President, Aviation Corporation.*

Open the doors of the schools to all who want to learn. — *Superintendent.*

Very few people hold only one job during a lifetime. People find themselves through evening school courses. — *Mid-West Superintendent.*

22. Students of day trade schools and classes should devote at least one half of the school day to shopwork in order to give them the experience and training nec-

essary for trade. This is exactly what the Smith-Hughes Law specifies, and in the opinion of a majority of leaders of labor, management, and education it is a sound practice. If such courses are delayed until the last years of high school, they will not interfere with the general education of students. In the earlier years students should take industrial-arts courses, which are less specialized in character and which require less time.

Usually this (half of the school day in the shop) is desirable, but there are many cases where it is not. — *Director, Independent Union.*

Maintain a balance between books and shop. — *Manager, Battery Manufacturing Company.*

Effective trade training cannot be done with less than half time spent in shop work. — *New York Superintendent.*

23. School shops should be made available, *under careful supervision*, to the patrons of the community for *training* and assistance in farm and home maintenance. They should remain open during the summer months for training purposes for youth and adults. The community has too much invested in its school shop and too great a need for its services to keep it closed a fourth of the time.

By all means this (school shops available to patrons of the community) should be a *must* requirement. — *Executive Secretary, C.I.O. Council.*

This is an excellent plan. — *State Director, C.I.O.*

Schools should be used to the fullest extent, consistent with local needs. It would be necessary to enlist proper supervision to prevent damage to machinery and equipment. — *Treasurer, Manufacturing Company.*

A very useful service which wins loyalty for the school and its budget. — *Teacher-Trainer.*

(Keeping shops open to youth during summer months) May have a beneficial affect on juvenile delinquency problems. — *Director, Public Relations, Steel Corporation.*

This is a part of the growing community philosophy. — *Ohio Superintendent.*

24. Public school shops and equipment should not be used for the production and sale of goods and services in competition with private business and industry. This does not preclude the making of nonsalable projects or the performance of nonsalable services essential for training purposes in the school shop.

No public institution should compete with private enterprise or organized labor. — *Regional Director, C.I.O.*

Competitive industry survives only in areas of *fair* competition. In this (making salable goods in school shops), the students have an unfair advantage. — *Vice-President, Machinery Manufacturing Company.*

The schools should not enter competition with labor and management. — *New York Superintendent.*

25. In areas where facilities for vocational-industrial education cannot be made available otherwise, state or area vocational schools should be established. This will necessitate careful study of population, occupations, present training facilities, transportation and finance within the area. It will call for a co-operative arrangement with feeder schools and for democratic local control. One of the most difficult problems of the area school can be solved by confining enrollment to high school graduates and others who can secure the consent of the principal of the feeder school.

Trade schools should be where needed and they should be molded around available employment possibilities, rather than being placed in certain pre-arranged places. — *President, Industrial Union Council.*

Should not be enforced on local schools where local conditions should govern. — *Chairman, Construction Company.*

Emphatically, yes, and financed by the state. — *Superintendent.*

If area schools also include general education. We cannot favor a school which offers only vocational education. — *Missouri Superintendent.*

26. If we are to have a well-balanced program of industrial education, industrial arts as well as vocational-industrial education should receive federal aid. Although certain groups oppose federal aid for all education, it is generally believed possible to receive such aid without undue federal control. The Federal Government, co-operating with the states, should determine the general policies pertaining to federally aided education, but the purposes for which such funds may be spent should be determined by the states and local communities.

Federal aid should be available to all education. — *Official, Machinists Union.*

The control should be exerted by the state rather than by the federal government. — *Educational Director, C.I.O.*

This (state and local determination of purposes for which funds may be spent) is a sound principle, providing there are basic minimum standards required and agreed to. — *National Representative, A. F. of L.*

Depends on how federal aid is given. The Supreme Court has said, "Those whom the federal government subsidizes, the government may control." Look out! — *Director of Training, Manufacturing Company.*

Always stay clear of federal control, even at a loss. — *Vice-President, Manufacturing Company.*

Right you are (state and local communities should determine purposes for which funds may be spent). — *Training Director, Aircraft Corporation.*

If industrial arts ever receives federal support for classes, most trade and industrial education will disappear. — *Teacher Trainer.*

We made a mistake in this country when we began to subsidize only a part of education. — *Minnesota Superintendent.*

The amount of federal control which now exists is unnecessary and unfortunate. — *Iowa Superintendent.*

General purposes (for which funds may be spent) should be determined by the federal government. — *Washington Superintendent.*

Equipment

27. For general industrial education (industrial arts) purposes, school shops should be equipped with a wide assortment of the best grade of hand tools, and with a carefully selected list of small to medium size but substantially built machine tools. The best grade of hand tools will be the cheapest in the long run, and the small machines may be replaced without great expense when they are worn out or become obsolete.

The objective should be training and education and not immediate production. — *Official, A. F. of L.*

The equipment should be light; however, it should be good and top grade. — *General Foreman, Aircraft Corporation.*

It is better to provide the small equipment. — *Wisconsin Superintendent.*

28. For vocational-industrial education (trade training) purposes, school shops should be equipped with the best and most modern equipment found in industry. However, schools should be extremely careful, now that "white elephants" are on the move again, not to fill their buildings with useless machines just because they may be had at small cost. If a machine is unfit for educational purposes, it has no place in a school shop.

A cross section of the equipment found throughout industry should be used. — *Vice-President, National Labor Association.*

Sufficient equipment should be provided to insure all-around training in each field. — *Treasurer, Manufacturing Company.*

Greater use should be made of the equipment in the industries rather than duplicating it in schools. — *Superintendent.*

29. Successful trade experience and a college education are both desirable for teachers of vocational-industrial subjects in the full-time school. However, trade experience is definitely the more important of the two. If a teacher is master of his trade, it matters little whether or not his experience has been confined to one trade or spread over several related trades. The ability to teach is of primary importance in any event.

Trade experience more important than college degree. If we can have both, fine, but not compulsory. — *Official, City Industrial Union Council.*

In small localities a teacher with two or more trades is best suited. — *Union Official.*

Should have trade experience. College degree is desirable but not entirely necessary. — *Personnel Director, Manufacturing Corporation.*

Varied experience probably makes the best teacher. It is desirable that an instructor in a given subject not be of a single work mind. — *Vice-President, Corporation.*

A college degree is desirable. Trade experience is indispensable. — *City Supervisor.*

Try and get them (trade teachers with both trade experience and a college degree). If one was fool enough to quit a good job to enter teaching, he wouldn't have sense enough to teach. — *Indiana Superintendent.*

Experience in trade being taught must be sufficient to command respect of students in the particular trade. — *State Supervisor.*

30. A college education is more important to the teacher of industrial arts than

trade experience, although the latter is definitely desirable. His position demands less skill, perhaps, than that of the trade teacher, but he must have a broader understanding of children and of the educative process.

Industrial-arts teachers would not need to have had trade experience. A college education of the right type would be helpful to all teachers, but not always necessary. — *National Representative, A. F. of L.*

At least equivalent of college degree . . . (trade experience) optional. — *President, Tool Company.*

Industrial-arts teachers can be adequately prepared with little or no trade experience. — *Teacher Trainer.*

The foregoing statements represent the consensus of opinion of leaders of labor, management, and education as revealed in the afore-mentioned study. Although other opinions were expressed, those quoted are *typical* of the *majority* opinion of the groups represented. It is believed, therefore, that they are valid indicators of the type of industrial-education program which the public schools should develop in the years ahead. No claim to completeness is made. Beyond these statements and expressions of opinion, those planning postwar programs will, of couse, need facts about the peculiar interests and needs of the community to be served. The two should be checked and balanced against each other in arriving at decisions, and in setting up suitable curriculums.

Brief History of Industrial Arts and Vocational Education

*Erhard F. Wendt**

Early Trade Training in Europe

Sporadic attempts at education in industries are to be found in early Greek and Roman history. A resemblance of a school for cooks, hairdressers, mechanics, and architects existed at this early date. People from early times recognized that the learning of a trade was an economic necessity. A more formal education in the trades was begun in the fourth century with its introduction in monastic schools. These schools were especially interested in the artistic crafts. The arts of copying and illuminating manuscripts along with gold and silversmithing were especially successful. The initiation of the movement of manual and industrial education seems to fall into three distinguishable groups. The first period is that in which progressive writers present the formal education in crafts as a feature of ideal states. The second period is that in which certain progressive writers plan courses of study. The third period finds the actual introduction of trade training introduced in schools.

In the first period Thomas More's *Utopia* is one of the outstanding writings. In this ideal state every citizen would be required to learn agriculture and one craft.[1]

Campanella's *City of the Sun,* was another ideal state in which the author divided the city into seven walls, forming seven concentric circles. The surface of each wall was to be used for purposes of public education. Each wall was to be covered with pictures, specimens, or diagrams in some one study. The sixth wall was assigned to industries. Education in the utopias was for rich and poor alike.[2]

A more definite education in the crafts begins at the time of the Renaissance. The development of the art of printing was the factor that gave impetus to education.

During this period there appeared two of the fundamental ideas upon which modern education in the manual arts has been built. The first of these is that the sense impressions are the basis of thought and, consequently, of knowledge. The second is the related idea of learning by doing. Out of the first idea grew the object method of teaching, and later the laboratory method; through the second came the recognition of the value of working through a process, of making something with the hands or with tools, of doing something skillfully, as a basis of rational thinking. This idea led to the placing of handicrafts in the school, and the children in the work-shop and in the field to receive instruction.[3]

The increasing importance of industrial education during the early part of the seventeenth century seems to be due to several factors. First, the reaction against the theological formalism, helped promote it. Second, school education in the learning of a trade was recognized as a means of relieving poverty and destitution resulting from the wars of that period. Third, recognition by leading writers of that period encouraged it. Fourth, the tendency of the time was to break from the traditional.

Andreae's *Christianopolis* marks the transition to the second stage in the development of the theory and practice of industrial education. In describing the nature of instruction, he says:

The young men have their study periods in the morning, the girls in the afternoon; and matrons as well as learned men are their instructors . . . . The rest of their time is devoted to manual training and domestic art and science, as each one's occupation is assigned according to his natural inclination.[4]

The sixteenth-century writers advocating industrial education felt that this type of education would be ideal, but were doubtful whether this goal could be attained.

Early Industrial and Vocational Training in America

One of the earliest attempts at this type of education in America was made by the Franciscan schools located in New Mexico about 1630. These schools were patterned largely after the monastic schools in Europe. Up to nine years of age the children were taught reading, writing, catechism, singing, and playing on musical instruments. From the age of nine years on, the work of the pupils was wholly industrial. Industrial education consisted of courses in tailoring, shoemaking, carpentry, blacksmithing, bricklaying, carving, and stonecutting. The girls were taught how to sew and spin. The Indians were naturally skillful, and the missionaries made the most of this in their economic system. At first the missionaries were the teachers, but later on the most skilled natives were used for that purpose. All these schools and their records were destroyed in the rebellion of 1680. A few years later similar schools were established in Texas. Missionary schools in California and Florida operated on a basis similar to those formerly in New Mexico.[5]

In the Middle Ages apprenticeship was the principle means of education for the

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[1] L. F. Anderson, *History of Manual and Industrial School Education,* p. 7 (New York City: D. Appleton and Co.).

[2] *Ibid.,* p. 9.

[3] Bennett, C. A., *History of Manual and Industrial Education Up to 1870,* p. 30 (Peoria, Ill.: The Manual Arts Press).

[4] *Ibid.,* p. 11.

[5] *The History of Manual and Industrial Education Up to 1870,* C. A. Bennett, p. 73 (Peoria, Ill.: The Manual Arts Press).

average class of people. The majority of people received no education. Through apprenticeship the youth was given a general education as well as a technical education. In some crafts where the period of apprenticeship was for more than seven years, the apprenticeship agreement called for certain schooling in general. Guild masters were assessed a fine for failure to comply with this rule. England in 1562 had a national regulation of apprenticeship and trade laws.

In the English colonies in America, apprenticeship in Colonial America retained the essential characteristics of the mother country. The colony of New Plymouth in 1641 passed an act placing poor children in the homes of more fortunate people where their apprenticeship would be provided for. In 1671 New Plymouth passed a law penalizing those who neglected to educate their youth in a trade.

The movement in England for greater attention to the sciences and industries in education had its influence upon education in America. President Hoar of Harvard, due to a long residence in England, planned to inaugurate the teaching of mechanic arts at that school. A more definite plan for formal industrial-arts education in America was proposed by Thomas Budd in 1685. He listed various trades in which both boys and girls were to be schooled. In the daily program, the instruction in the various manual arts was given for two hours each morning. Practically no progress in industrial education was made from 1700 to 1775 in the United States.[6]

Defects in the Apprenticeship System

Long before the advent of the Industrial Revolution several serious defects were found to exist in the apprentice system. The tradesmen or masters were merchants as well as artisans. Soon the masters had become employers, and delegated the education of the apprentices to his journeymen. Sometimes as many as five apprentices were assigned to each journeyman. The father and son relationship between apprentice and master ceased to exist. Apprentices very often became specialists in only one phase of a trade due to the production efforts. Apprenticeship periods were long and the learner lost interest in his work. The decline of the apprenticeship system was most marked in the last quarter of the eighteenth and first part of the nineteenth centuries. Labor-saving devices began to appear, and were developed rapidly, especially in the textile industries. In 1769 Arkwright patented his cotton spinning frame. In the same year Watt patented a steam engine. The following year, 1770, Hargreaves invented the spinning jenny. In 1779 Crompton combined the inventions of Arkwright and Hargreaves to make the spinning mule. Slater established a cotton mill in 1789. Weaving did not become a factory occupation until after 1814, when the first power loom was used. By this time the apprenticeship system had practically ceased to exist.

Agricultural School Started

Between 1775 and 1800 one of the leading vocations taught was that of agriculture, although mechanic arts were in many instances also offered. The de la Howe State School in South Carolina, a school still in existence today, was endowed as an agricultural school in 1779.

Previous to 1800 there were only a few instances of schools that taught handwork. Perhaps the most outstanding of the formal schools that taught handwork were Cokesbury College in Maryland and an academy at Bristol in Pennsylvania.

In the year 1800 B. G. DuPont, at the request of Thomas Jefferson, drew up a plan for national education in which education in the industrial arts had a prominent place. DuPont, believing much as Rosseau did, recognized the desire of children to "move, act, and accomplish things." Actual handwork with tools is recommended only as one of the various forms of occupation for hours of leisure.

America from colonial times accepted the principle of education at public expense. Care and education of certain types of children such as orphans, feeble-minded, deaf, and blind were largely taken over by philanthropic institutions. Some of these schools have contributed much to industrial education. One such example was the Farm and Trades School established at Boston in 1814. Nearly a dozen occupations and trades were taught in this school.

One of the reasons advanced in America for the teaching of mechanic arts was the fact that homes were quite isolated, and therefore, at least one member of the family should be skilled in them.

America Introduces the Mechanics Institute

The Mechanics Institute had been developing in Europe for a number of years, and in 1820 was introduced in America, when the General Society of Mechanics and Tradesmen of the City of New York opened a mechanics school. This school provided adult workmen with an opportunity for technical training. The second and the most famous of the mechanics institutes in America was the Franklin Institute in Philadelphia, established in 1824.[7] At about the same time the American Lyceum was established to serve both the cultural and vocational needs of adults. The Mechanics Institute and the Lyceum movement were the outcome of the desire to teach science and mathematics in so far as they were related to the various vocations being learned. The Gardiner Lyceum was an outstanding school in its day. Rensselaer established a similar Lyceum, and, in addition, offered a teacher preparatory course.[8]

About two decades prior to the Civil War, the people living in the frontier states began to demand education for the masses. This was in contrast to the rather small professional class for whom most of the schools in the eastern part of the United States had been established. Frontier people wanted a practical education. The most vigorous movement seems to have been initiated in Illinois. A request for land endowments to support secondary schools was made by Senator Morrill of Vermont in a bill he introduced in Congress in 1859. The bill was vetoed by President Buchanan, but in 1862 was again introduced and passed. It was signed by President Lincoln. This act gave a state thirty thousand acres of land for each senator and representative in Congress. The money derived from the sale of these lands was to be appropriated to the endowment, support, and maintenance of at least one college where:

"Without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe . . ."[9]

The passage of this bill also had been given strong support in the eastern states. This act was amended in 1890 giving a supplementary appropriation of $50,000 to each state. The Nelson Amendment of 1907 extended these aids to the insular possessions of Hawaii and Puerto Rico.[10]

Drawing Introduced Into the Curriculum

American merchants in the sixties and seventies, because of the pressure of international competition were led to the demand for a more direct industrial education of youth. One result of this demand was the introduction of drawing. There had been earlier attempts to organize drawing courses, but their main value had been the fact that they expanded the school program, rather than for their intrinsic value. Drawing in the early days was regarded as something for a fashionable boarding school, or the type done by the scientific engineer. Drawing, as advocated by Peale, was to start with tracings of figures, and then to proceed to nature drawings. Following freehand drawing, the student was to attempt mechanical drawing.[11] Most educators felt that these types of drawing were to be included, but the sequence was a point of difference. One book, for many years considered a standard textbook on the subject, began with definitions, then geometric problems, including construction of geometric figures. This was

[6] Bennet, C. A., *History of Manual and Industrial Education Up to 1870*, Chronological Chart, p. 445 (Peoria, Ill.: The Manual Arts Press).

[7] C. A. Bennett, *History of Manual and Industrial Education Up to 1870*, p. 319 (Peoria, Ill.: The Manual Arts Press).

[8] L. F. Anderson, *History of Manual and Industrial School Education*, p. 141 (New York: D. Appleton and Co.).

[9] *Ibid.*, p. 152.

[10] *Ibid.*, p. 154.

[11] Bennett, C. A., *History of Manual and Industrial Education Up to 1870*, p. 432 (Peoria, Ill.: The Manual Arts Press).

followed by sections and developments. Then followed arch design, simple architecture, and gears. Lastly, isometric, perspective shadows, and colors were given.[12] Cincinnati became one of the foremost cities of the entire nation in making drawing a definite subject of instruction in the public high schools.

The Russian System

For a long time it had been realized that the most important feature of industrial education was in the direct cultivation in the use of tools. For this no efficient system of school education had been found. Prior efforts concerned themselves mainly with the placement of industrial arts and its claims to importance in school education. Need for such a course was felt especially in the engineering schools where graduates found it necessary to supplement their learning with a long period of apprenticeship after their graduation, in order to fit themselves directly in positions open in manufacturing plants. A similar difficulty had been overcome in the teaching of sciences by the use of the laboratory method. In the hope of finding some acceptable method of teaching manipulative skills in connection with the regular college work, Runkle, president of Massachusetts Institute of Technology, visited the Centennial of 1876. The system he was in search of was found to be presented in an exhibit by the Imperial Technical School of Moscow. The plan in brief, was that of analyzing workshop operations into their elementary processes, of arranging these in a graduated series, and making them the object of systematic drill by the student. The product of the student's work had no utilitarian value. These manipulative exercises were to serve the same purpose to the manual arts student that finger exercises did to the pianist. If fundamental tool processes and manipulations were learned, extensive training in an isolated field need not be given. According to A. F. Siepert:

> It is generally conceded that the idea of analyzing the mechanical trades into basic tool processes and elements of construction came to America from the Russian program of engineering education developed under the leadership of Della Vos, director of the Imperial Technical School at Moscow. His analysis dealt with the mechanic arts as practiced some 75 years ago in a foreign country. The Russian course of study was arranged on three levels: (1) care and use of tools, (2) elements of construction, such as typical joints used in woodworking industries, (3) application of these tool processes and elements of construction to actual projects.[13] The method of instruction developed under Della Vos was designed for the convenient handling of large classes. The instructor demonstrated the use of a tool, or the procedure to follow in constructing a joint, giving verbally such related information, suggestions, and cautions as his judgment dictated. Then the individual students were expected to go to their assigned workbenches or machines to reproduce whatever they had seen in the demonstration. Working drawings were furnished to give information as to sizes and shapes of the exercise pieces or projects.
>
> Under the leadership of such men as Runkle of the Massachusetts Institute of Technology, and Woodward of Washington University, St. Louis, the first shopwork in the United States to be based on an adequate analysis of the mechanic arts for either the engineering college or for the high school was patterned after the Russian system.[14]

The credit for definitely establishing manual training in the public high school must be given to those responsible for the establishment of the Baltimore Public Manual Training School in 1883. All the features of the high school were retained and a manual training department was added. The classes were taught by a manual training school graduate from the University of Washington in St. Louis. The spread of this system was rapid in the eighties. The manual training movement at this time had four objectives. First, by furnishing an outlet for the constructive impulses, it supplied what so far had been lacking in general education. Second, it made school training more purposeful. People could recognize a more definite relationship between school and industry. Leaders in the movement however never did maintain the claim that it would replace vocational training. They did, however, recognize its value in the preparation for industry in a general way. Businessmen seeing the close association between school and industry became enthusiastic supporters of the movement. Third, the cultivation of habits of industry was felt to be very important, and fourth, manual training in the schools was expected to develop a respect for the manual laborer and so raise the social status of the working class.

In the late eighties manual training was a popular topic for discussion in the public press and in educational meetings. At this time the National Education Association endorsed the manual training movement. Although the sentiment in favor of introduction into the public schools was constantly growing, the reasons advanced for its introduction were varied. Some supporters felt that the schools were educating against manual labor, in that schools were preparing mainly for white-collar jobs, and for that reason it should be introduced to elevate the social status of the manual laborer. Others demanded it because the large majority of pupils were not in a position to take advantage of the college preparation that had been thrust upon them, and therefore, should have something of a vocational nature in the high school. Many believed that manual training should be offered only as a part of a general education. Others felt that manual training should be taught as a branch of industry.[15]

The Sloyd System

Due to the fact that the Russian system was so enthusiastically received, and because it provided a definite system, the popularity of the manual training system had made rapid gains. Once the initial enthusiasm had worn off, and judgment given after a period of trial, the system revealed serious defects. The work produced an object that had no use and possessed no beauty. The result was that this type of work held little attraction for the American youth. These defects caused educators in America to seek another method or system. The sloyd system seemed to satisfy more fully the child's creative impulses and in other respects seemed to be more fitted to the nature of a child. The peasant classes in the northern European countries had for centuries supplemented their farm labors with various handicrafts. The youth of these families learned the handicrafts practiced by their elders, and became quite adept in tool manipulations. The interests in handicrafts developed in the home was responsible for the early introduction of crafts in the Finnish and Scandinavian schools. Cygnaeus, a Finnish reformer, laid down several principles later adopted as fundamental in the sloyd system. He held that the work was not to be vocational, but, neither should it be a study devoted to trifles. An improved system of sloyd was developed by Salomon, a Swedish educator.[16] The sloyd system was the first system to gain world wide recognition. Salomon had students from thirty-one countries in attendance at his school for teachers.[17]

The Swedish sloyd system was brought to the attention of American educators by Prof. John M. Ordway, for a time director of the School of Mechanic Arts at Boston, the pioneer Russian system school founded by Runkle.

The following are the distinctive features of the sloyd system: first, the emphasis laid upon the mental and physical development of the child rather than upon the mere acquisition of skill in the use of the common tools; second, the carefully arranged sequence of the exercises and the care taken to adapt them in other respects to the nature of the child; third, the restriction of the work of the pupil to the making of complete articles, valuable for their usefulness or for their beauty; fourth, the importance attached to the knife as being the first and fundamental tool; and fifth, insistence upon trained teachers as instructors.[18] As related by Siepert:

> In the Swedish development only pupils of grammar grade age were under consideration. The doctrines of interest, of individual

[12] *Ibid.*, p. 433.

[13] "It is found that the forger's art is substantially included in the six following elements: first, the management of the fire and the degrees of heat; second, bending without changing the cross section of the bar; third, drawing down or reducing the cross section; fourth, increasing its cross section; fifth, welding; sixth, hardening and tempering." *History of Manual and Industrial School Education*, L. F. Anderson, p. 138 (New York City: D. Appleton and Co.).

[14] Bawden and Others, *Industrial Arts in Modern Education*, pp. 84–85 (Peoria, Ill.: The Manual Arts Press).

[15] L. F. Anderson, *History of Manual and Industrial School Education*, p. 176 (New York City: D. Appleton and Co.).

[16] *Ibid.*, p. 184. [17] *Ibid.*, p. 185. [18] *Ibid.*, p. 186.

differences, of gradation in difficulty of learning material, were at least partly recognized and provided for. Hence, the method of teaching was that of individual or small group instruction. Here the instructor was expected to demonstrate the making of each model to the class, or to a group whenever such instruction was needed. As individual differences appeared and the pupils in the class became separated, neither class nor group instruction could be continued, thus calling, practically, for the individual instruction of each pupil. The inevitable result was that the Swedish system of sloyd made it essential to limit the class size to twenty pupils or less.[19]

The sloyd system, while conceded superior to the Russian system, also revealed defects. Sloyd, like its predecessor, did not appeal sufficiently to the aesthetic sense of the child. The use of precision instruments hindered the child in the appreciation of proportions. Procedure was rigid. This last objection was later overcome when leaders encouraged originality and initiative.

(To be continued)

[19]Bawden and Others, *Industrial Arts in Modern Education*, pp. 85–86 (Peoria, Ill.: The Manual Arts Press).

Seeing in the Schoolhouse*

William G. Darley[a]

(Continued from page 102 of the March, 1946, issue)

PART II

In Part I of "Seeing in the Schoolhouse,"[23] the more important factors influencing seeing were discussed. These are: the size of the object being viewed, the revealing brightness contrast between the object and its immediate background, the readability of the material, the time allowed for seeing, the brightness of the task, the disturbing brightness ratio between the task and its surroundings, the acuity of the eye, and eyeglasses; whether intermittent or concentrated attention is required, and whether short or prolonged periods are involved.

The Utilization of Aids to Seeing

The degree of utilization of any aid to seeing (type size, revealing brightness contrast, brightness, eyeglasses, etc.) may be represented diagrammatically by the position of the arrow in Figure 8.[24] The setting of the arrow also represents a degree of ease of seeing. One may change the position of the arrow by turning the knob "K." Except for the condition of maximum utilization of any aid to seeing, any setting of the arrow actually represents a compromise between costs of and benefits from any specific aid. In the lowest position, the specific aid is utilized minimally. It may be the illumination to produce a brightness for barely seeing, or it may be the smallest type size that can be seen under given conditions, etc.

As previously mentioned, within certain limits, increasing the "size" of an object increases its visibility and the ease with which it may be seen. Thus, the 3-point type in Figure 9 is not as easy to decipher as is the 12-point type. On the other hand, many more words can be contained on a given size page if 3-point type is used. Hence, the size of the type used for a publication depends upon someone's evaluation of the benefits of a larger size vs. the greater cost of the printed material when the larger size is used. For example, the average type used for the text matter in newspapers is approximately 7 point (Fig. 9). It is obvious that 10-point and 12-point sizes, which are used in many books, are more desirable. Thus, the 7-point type represents an arbitrary setting of the pointer on the part of the publisher.

Again, a high revealing brightness contrast is an aid to seeing. One hundred per cent contrast, however, would cost a great deal (if it could be obtained at all). For most practical purposes, a maximum of the order of 95 per cent contrast is acceptable. When school authorities adopt the use of materials which result in a lower per cent contrast than this, they are compromising on the setting of the pointer.

As a generalization, readability of a given text improves as the space between lines (points of leading) is increased from 0 to 6 points (Fig. 9). A decision to use less than 6 points of leading for textbooks represents a setting of the arrow between the minimum and maximum utilization of this particular aid to seeing. This setting is based upon a long-term evaluation of the subjective reactions to the benefits of leading in improving readability versus the greater cost of books using more leading. The cost increases because of the increased number of pages required for a given amount of printed matter as the leading is made greater.

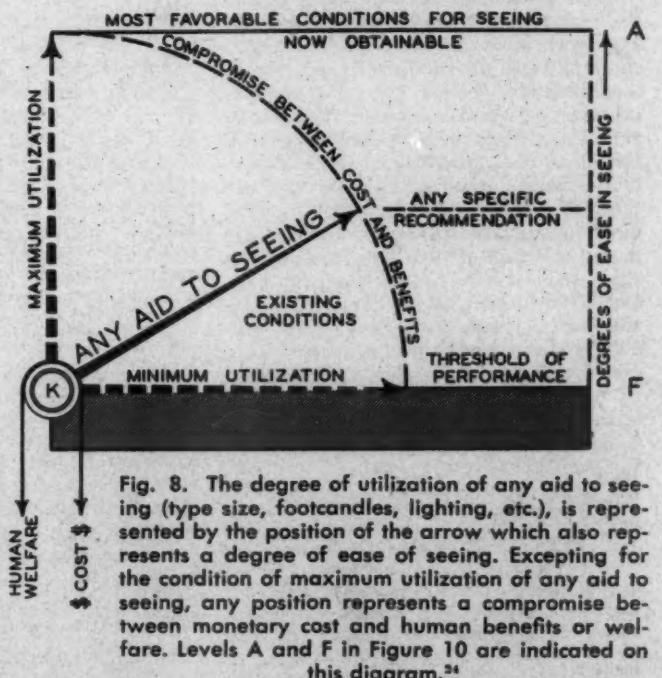

Fig. 8. The degree of utilization of any aid to seeing (type size, footcandles, lighting, etc.), is represented by the position of the arrow which also represents a degree of ease of seeing. Excepting for the condition of maximum utilization of any aid to seeing, any position represents a compromise between monetary cost and human benefits or welfare. Levels A and F in Figure 10 are indicated on this diagram.[24]

Low brightness ratios between the work and other surfaces in the environment are a considerable aid to seeing. Yet even with the best techniques available today, it appears impractical from a cost standpoint to obtain the uniform brightness pattern necessary to achieve the maximum utilization of this aid. Thus, while the Illuminating Engineering Society's Committee on Standards of Quality and Quantity of Illumination for Interiors states that for *ideal* seeing conditions, the ratio of the brightness of the visual task to the brightness of its immediate surroundings should be unity, the committee also states that *good* seeing conditions are attained when the brightness of the visual task is not higher than three times that of its immediate surroundings (limiting brightness ratio of 3).[25] (In any event, brightnesses in the immediate surroundings should not be higher than that of the task.) This

*Reprinted from the American School Board Journal, Milwaukee, Wis.

[a]Illuminating Engineer, Nela Park Engineering Division, Lamp Department, General Electric Company, Cleveland, Ohio.

again represents a specific recommendation somewhere between the minimum and the maximum utilizations of this aid.

Fortunately, in general the contributions which eyeglasses make to easier seeing cost no more for the maximum aid than for some point between the maximum and minimum utilizations. Thus, if a child needs a correction of + 2 diopters, it is not necessary to decide whether or not he can financially afford only ½ or 1 diopter, much less the 2, as is the case for some of the other aids to seeing. On the other hand, if 2 diopters did cost nearly twice as much as 1 diopter and if the cost was a very significant figure, it is quite possible that in many cases the decision as to the number of diopters to put in the lenses would be a compromise between cost and benefits.

For any given visual object or task involving specific seeing conditions, there are six definite levels of seeing as illustrated in Figure 10.[24] The visibility of the object or task may be raised from one level to another by increasing the utilization of one or more of the appropriate aids to seeing. In the following discussion, consideration of these aids will be limited to brightness. With proper brightness ratios achieved, the relative ease with which a task is seen can be controlled over a wide range by varying its brightness.

Brightness as an Aid to Seeing

With the work brightnesses resulting from present-day average artificial lighting in the classroom, the visibilities of seeing tasks therein may vary from near the threshold of visibility to near the optimum for ease of seeing. For *equal* visibility of these tasks, a wide range of foot-candle values would be required. It is possible in the laboratory to determine the foot-candle requirements for equal visibility of various tasks. The results of a series of such investigations is illustrated in Figure 11.[26] The foot-candle values indicated for the tasks are those required to provide a standard of visibility for the tasks equal to that of 8-point Bodoni type (Fig. 9) printed with black ink on good white paper illuminated

TABLE I. Foot-Candles Reasonably Available as of Today.

In general, the illuminations at the lower end of the ranges are available with filament lighting while those at the upper end are reasonably available with fluorescent lighting.

Location	*Range of reasonably available foot-candles average maintained in service*
Sightsaving classrooms, etc.	30–100
Classrooms, etc.	20– 50
Gymnasiums, etc.	20– 40
Auditoriums, etc. (not used for study)	10– 20
Reception rooms, etc.	10– 20
Corridors, etc.	5– 15

This is 7-point Bodoni type

This is 8-point Bodoni type

This is 12-point Bodoni type
with 0 points of leading (solid set)

This is 12-point Bodoni type
with 6 points of leading

Fig. 9. Illustrating 3-, 7-, 8-, and 12-point type and the effect of leading.

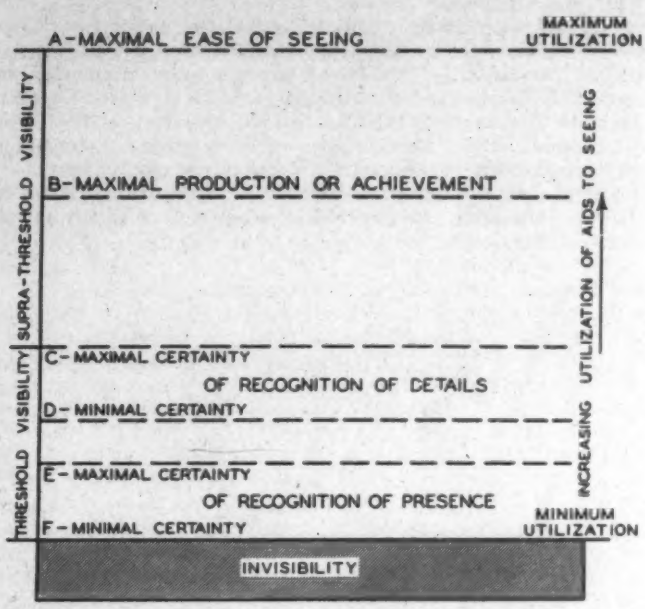

Fig. 10. For any given visual object or task, involving specific seeing conditions, there are six definite levels of seeing. The visual object or task may be raised from one level to another by increasing the utilization of appropriate aids to seeing. The various levels are merely arranged in a systematic order for the purpose of visualization.[24]

to 10 foot-candles as seen by an observer with so-called normal vision.

It would be possible to study every classroom seeing task and to determine a foot-candle value for it which would provide a desired degree or standard of visibility, as was done for those tasks in Figure 11. While this may be done eventually, for the time being it must be considered that the foot-candle level chosen for the classroom will provide more light than necessary for some tasks and not enough for others to have the degree of visibility selected.

Usually, persons with subnormal eyes need more light (a higher work brightness) if their ability to see is to approach that of those persons with normal vision. Hence, for example the handicap of astigmatism is not so great at higher values of illumination.[27, 28, 29] It would seem apparent therefore, that the provision of seeing conditions in the classroom should not be predicated upon the needs of "tough," normal eyes, but upon those of the most sensitive and defective eyes in the group.

Today some recognition of the difference in the ability of different eyes to see is noted by the establishment of sightsaving classrooms for those whose vision is or has become so defective that normal classroom tasks are below the sustained threshold of the student even when fitted with eyeglasses. (Actually, the purpose of the sightsaving classroom is to preserve what is left to some pupils of their precious gift of sight. And this is a good thing. But the place to *save* sight is in regular classrooms where there may be good sight to save.)

As was indicated by Figure 3,[22] the effect on seeing of increasing brightness is subject to the same natural laws as hearing and sound. That is, approximately equal responses to brightness and sound are obtained by doubling the quantity of light or the volume of sound, respectively. (A comprehensive discussion of this matter will be found in Part I of this article.)[23]

While it is evident that every added unit of brightness, or every added foot-candle, is an aid to seeing, it is apparent that it is more in keeping with the characteristics of the visual response to consider increments in brightness in terms of logarithmic steps as the visual tasks become obviously progressively more severe. Figure 12 illustrates this fact. As shown, in order to obtain *equal visibility* for the Snellen characters as they decrease significantly

in size in approximately uniform steps, the brightness (foot-lamberts) must be approximately doubled for each step. As a matter of simplicity, therefore, increments in brightness, or foot-candle levels, can be considered as shown in Figure 13. This chart divides the range from 0.7 to 1500 ft-c (foot-candles) into 10 classifications of illumination, each step upward representing an approximately equal increase in foot-candle effectiveness. The center of the "A" classification (range 70 to 150 ft-c) is 100 ft-c. This level is about 10 per cent of outdoor illumination on an overcast day.

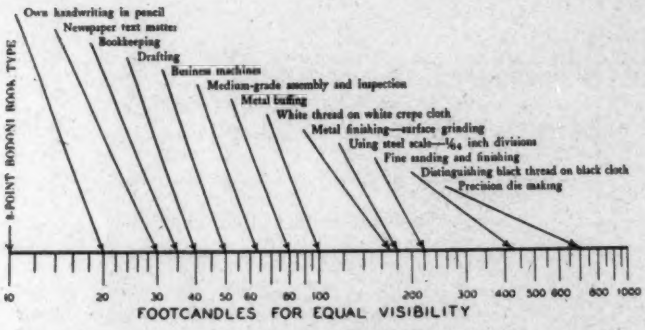
8-POINT BODONI BOOK TYPE
Own handwriting in pencil
Newspaper text matter
Bookkeeping
Drafting
Business machines
Medium-grade assembly and inspection
Metal buffing
White thread on white crepe cloth
Metal finishing—surface grinding
Using steel scale—1/64 inch divisions
Fine sanding and finishing
Distinguishing black thread on black cloth
Precision die making
10 20 30 40 50 60 80 100 200 300 400 500 600 800 1000
FOOTCANDLES FOR EQUAL VISIBILITY

Fig. 11. Showing the footcandle-level needed to make each task of the same visibility as 8-point Bodoni Book type (printed with black ink on white paper) when illuminated to a level of 10-ft-c.[26]

The use of this chart as a basis for foot-candle recommendations has a number of advantages. It gives a much more realistic appraisal of illumination levels required for visual tasks which are one or a number of times significantly more difficult than others. It allows a certain latitude in the exact level of illumination selected by individuals when they set the pointer for their own particular space for which a certain classification of illumination is recommended. It recognizes the inherent limits and potentialities of different light sources and lighting systems in producing foot-candles. Thus, if it is assumed that classrooms should be provided with Classification B illumination, some school authorities might choose[j] 30 ft-c as the average level to maintain in service while others might choose 50 to 70 ft-c. Again, some authorities might choose to use filament lighting which often has a practical limit of around 30 ft-c, while others might choose fluorescent lighting with a practical limit above 70 ft-c.

The ranges are also more practical from the standpoint of lighting design. The illumination found in service from a given lighting system will vary from the initial value with freshly painted walls and ceilings, clean reflectors and new lamps at proper voltage, to 70 per cent or less of this value as the system depreciates, particularly if voltage conditions are allowed to slip. Furthermore, with conventional methods of laying out artificial lighting systems, absolutely uniform illumination throughout the whole room is seldom realized. Practical considerations in making the layout and the variable influence of walls and other extraneous surfaces, such as chalkboards, which intercept and reflect light, influence the final results. As a rule, the illumination is highest in the middle of the space, lower at the walls and lowest in the corners. The variation may be as much as 30 per cent above to 30 per cent below the *average* calculated value. Hence, in some rooms designed for an average illumination of 50 ft-c in service, and maintained there, the foot-candles in the room may range from 35 to 65 ft-c.

A Visibility Goal

During the relatively short period that human beings have been subjected to mass education with the printed page as one of the fundamental educational tools, some changes have been made in the basic visual task of reading. Some of these, such as better papers, inks and printing, and higher brightnesses have contributed toward easier seeing. The changes have largely come about fortuitously as a result of technical developments, or as a result of subjective appraisals. In some instances the changes have resulted in less favorable seeing conditions.[k]

Today there are available scientific techniques for evaluating visibility and ease of seeing. By working with the various controllable aids to seeing it is possible to vary the visibility of a given task over a wide range. It is thus possible to establish some degree of visibility as a standard, and then determine what is required of the controllable aids to seeing to make a group of tasks respectively possess this degree of visibility (Fig. 11). The establishment of such a present-day working standard (setting the pointer in Figure 8 at some compromise value) is a job for a committee composed of representatives from *all* groups who are interested in seeing conditions in the schoolhouse, e.g., schoolhouse planners and operators, educators, parents, illuminating engineers, taxpayers, etc. It is possible, however, to list some of the attributes of the ultimate standard for conditions most favorable to seeing near vision tasks, such as reading. This standard may be referred to as a Visibility Goal, and since reading is such a universal and common eye task it can well serve as the basis for this ultimate standard. Some of the attributes of the Visibility Goal are given below:

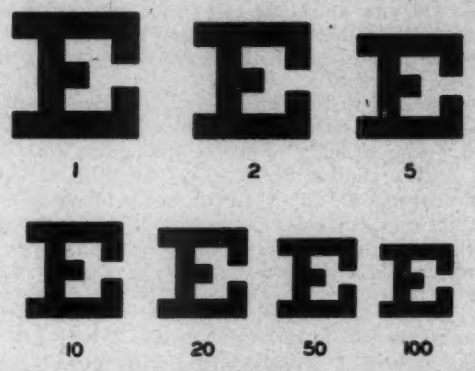

Fig. 12. Influence of brightness upon visual acuity as illustrated by Snellen characters. The numbers under the letter E are the foot-lamberts required for equal visibility.

Eyes and Eyeglasses

Full acknowledgment should be made of the right of every pupil to have an opportunity to enjoy an equal degree of visibility for the task. All pupils needing glasses should have them. For those pupils whose vision cannot be brought up to the so-called "normal" level, special steps should be taken to make their tasks approach the Visibility Goal as nearly as possible.

Size

For "normal" eyes the size of letter to use is controlled to some extent by Readability. It appears, however, that 12-point type is a reasonable goal.

Contrast

A goal of 95 per cent contrast is realizable.

Readability

The best (clearest) type face and the best combination of type size, line length and leading (space between lines) obtainable should be employed.

Time

The aim of the Visibility Goal is to reduce the time required to *see* to a practical minimum.

[j] Set the pointer in Figure 8.

[k] For instance, many business desks of a few years ago had a light oak finish. Metal desks which are being used now more and more are usually provided with black or dark green linoleum tops. For most desk work, these tops result in definitely more disturbing brightness ratios than did the light oak tops.

LEVELS OF ILLUMINATION

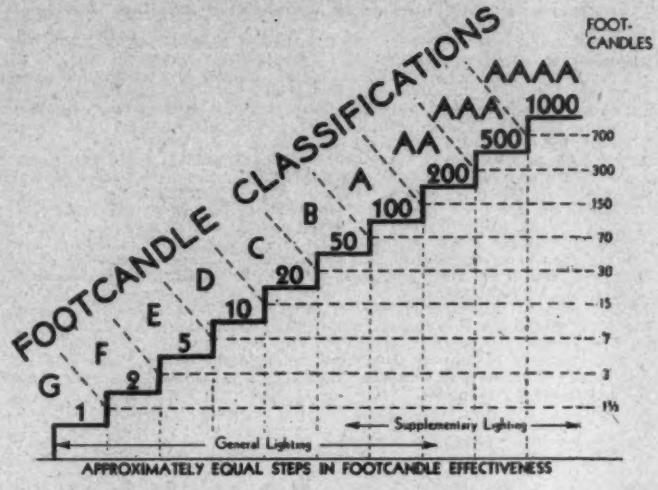

Fig. 13. A practical interpretation of the natural laws governing the usefulness of increasing levels of illumination on seeing ease.

Attention to Task

Another aim of the goal is to permit concentrated attention on the task.

Duration of Task

It should be possible for the task to be accomplished for prolonged periods; however, regular times for resting the eyes should be provided.

Brightness

The brightness of the task should be of the order of 250 foot-lamberts.[l]

Brightness Ratio

The task should not be more than three times brighter than surfaces in the surroundings and such surfaces should not be brighter than the task.

An Uncontrollable Factor

It must be kept in mind that as long as the eyes of the human seeing machine are geared naturally for distant vision, the attainment of the Visibility Goal for near vision tasks will only ease the burden which these tasks place upon the eyes.

* * *

Some of the above attributes of the Visibility Goal will be accepted without question; some may not. For instance, in the past there have been occasions when changes in brightness (foot-candle) standards have led to more heat than light according to *Time Magazine*. While it is obvious that the brightness goal cannot be considered as a standard for the classroom today, the following discussion is offered as a further contribution toward a better understanding of this particular matter.

Only recently have the ideas expressed with reference to the attainment of optimum seeing conditions been generally understood sufficiently well to form the basis for even tentative goals for visibility levels from the standpoint of brightness (foot-candles). In the absence of such an understanding, it is natural that current good practice foot-candle values should have been interpreted as "standards" for providing *adequate* visibility levels in the schoolhouse. That these "standards" have been consistently increasing during the past quarter century or more has led to some general confusion. An appreciation of the concepts of the *balance between benefits and cost* and of a *goal* may go a long way toward bringing about an understanding between school authorities and illuminating engineers as the foot-candle values adopted for good schoolhouse lighting practice increase in the future.

The brightness goal of 250 foot-lamberts is achieved with an illumination of about 300 ft-c on a nonglossy surface having a reflection factor of 80 per cent. As a matter of interest, 300 ft-c is sometimes available on desks and tables located close to large window areas.[m]

If 300 ft-c is considered as a goal for the reading of good black print on white paper, it is obvious that in sewing classrooms where the reflection factor of the material is quite low and the revealing brightness contrast between the detail being observed and its background is also low, the illumination goal would be much higher than 300 foot-candles. It might be as high or higher than the highest foot-candles provided by the best natural lighting. (If one is trying to discern details on black cloth, the resulting visibility with 10,000 foot-candles of natural lighting may still leave something to be desired.)

Goals for other spaces where the eyes are not used intensively or for long periods of time, or the seeing tasks are not severe, would be according to the seeing requirements. It must be kept in mind, however, that while it might not take a very high brightness in a corridor to provide practically optimum conditions for the seeing tasks therein, such areas may be entered directly from well-lighted classrooms. Eyes adapt quickly when suddenly moved into a higher brightness environment. They may, however, take ten times as long for the change from a bright environment to a dark one.

Illuminations Reasonably Available

As previously indicated, the illumination levels required to reach the Visibility Goal are in general unattainable practically under present conditions, though for some tasks and for special cases they can be provided. Values of illumination which are reasonably available today are, however, indicated in Table I. These values take into consideration practical capacities of wiring systems, efficiencies of available light sources and luminaire types, lighting costs as a part of the cost of education, etc., as well as the demands of the visual tasks in the various rooms. It is indicated that higher values are reasonably available with fluorescent lighting than with filament lighting. This is because of the higher efficiency of the fluorescent lamps and the higher utilizations of some acceptable forms of fluorescent lighting.

It is not the intent of the author at this time to recommend specific foot-candle classifications (Fig. 13) for the various areas in the schoolhouse. A period is required for school authorities to explore the potentialities of fluorescent lighting, to reconsider the characteristics of the visual tasks in the classroom and to re-evaluate the worth of the eyesight which is in their custody. It is logical to assume that this period will result in new settings for the pointer (Fig. 8) for the various areas in the schoolhouse.

It is true, of course, that foot-candle classifications could be established for the schoolhouse based upon those utilized in the work-world for comparable seeing tasks. It is appreciated, however, that in the work-world the benefits are more tangible. There 50 to 100 ft-c are used because they draw more people to baseball games, they increase production, reduce spoilage and improve morale in the office and in the factory, and they sell more merchandise in the store. It is hoped that time will establish the relative importance of these things versus helping to ease the burdens on the eyes of young America.

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[l] In considering the value of 250 foot-lamberts as a goal, it is recognized that this is a value indicated by present knowledge and subject to more accurate determination as studies are continued. Future researches may more probably require an increase in the value rather than a decrease.

[m] The eye evolved largely under daylight conditions with brightnesses from tens of foot-lamberts in the shade to as high as 5000 foot-lamberts for white snow on a clear winter's day. The brightness of green grass in sunlight on a clear July day (certainly a comfortable brightness to have in the field of view) ranged from 400 to 900 foot-lamberts depending upon the angle of view. Researches have indicated a greater efficiency for the human seeing machine where brightnesses comparable to those found outdoors have been employed.

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Techniques Used in Teaching Machine-Shop Operations to the Blind

*Robert S. Hunter**

The problem of vocational adjustment for the blind is an acute one. Many organizations are constantly seeking a solution, and the federal, state, local, and private agencies co-operate to lighten the burden of the visually handicapped. But even their valiant efforts have fallen short of the goal. Howeiler[1] reports from a study in California that "only 39.8 per cent of the employed blind of that state had been trained for the occupation in which they were engaged at the time the study was made, while 60.2 per cent were reported as having no training whatsoever." He adds that "there is a good reason to believe that the results from this study are representative of the nation as a whole." These findings suggest that the need for vocational training for the blind exists.

Local agencies for the blind, within the Pittsburgh area, are alert to the possibilities of vocational training for their charges. The three agencies are: The Pennsylvania Association for the Blind, The Pennsylvania State Council for the Blind co-operating with the Bureau of Rehabilitation, and The Western Pennsylvania School for the Blind. Together they work toward the common goal. But the association first conceived the idea of machine-shop training for blind adults. The three officers responsible are: Guy H. Nickeson, Annabelle C. Davis, and John P. McGettigan. Mr. McGettigan became the intermediary between the association and the vocational department of the Pittsburgh board of education. He approached the supervisors of trade training, and the National Defense Training Division became the medium through which machine-shop training was to be accomplished. Charles F. Hoffmaster, supervisor of National Defense Training, and Mr. McGettigan worked together to start a machine-shop class for the blind.

Accordingly on October 3, 1943 in the Morse Vocational School the machine-shop course for blind adults began. Eight blind, both male and female, out-of-school trainees were enrolled from the Pittsburgh area, and the class operated on an eight-hour, five-days-a-week basis with R. E. Buerkle as machine-shop instructor. Toward the end of the course additional adult blind were admitted. The training period lasted six months. Some of these trainees, however, found it difficult to support themselves while in training, and so, the Pennsylvania State Council for the Blind rendered the necessary assistance. In addition, the State Council, through the efforts of W. Harold Bleakley succeeded in enrolling a younger group of blind trainees from the Western Pennsylvania School for the Blind. The superintendent, B. S. Joice, co-operated in this experimental venture. In the fall of 1944 the place for training was changed from the Morse Vocational School to the Schenley High School, and the part-time training lasted through May, 1945.

In any training program one measure of its success is the extent to which trainees are placed in industrial jobs directly related to the type of training received. Consequently, what happened to the blind trainees is of special interest. As a result of Mr. Bleakley's efforts he reports placement for the following:

Trainee	*Directly related to training*	*Partially related to training*	*Not related to training*	*Months of work*
1		Punch press operator		9
2		Punch press operator		15
3	Drill press turret lathe power hack saw			15
4	Power hack saw			15
5			Paint sprayer	10
6		Assembling		16
7		Reconditioning carburetors, brake shoes		13
8		Reconditioning carburetors, brake shoes		18
9			Folding paper towels	2
10			General labor	2
Totals	2	5	3	
Per cent of total	20	50	30	

*High School, Turtle Creek, Pa.

[1]Howeiler, George L., "Can Our Vocational Schools Help the Blind?" Industrial Arts and Vocational Education Magazine, Volume. 31, No. 35, pp. 190-193, May, 1942.

The placement record for the blind trainees is gratifying. Seventy per cent of them were either placed in work directly related to the training or in work which was partially related, while only 30 per cent were placed in work not in line with their training. The average number of months of employment for the group is 11.5.

Besides the successful placement of blind trainees Mr. Bleakley reports still another type of training, namely, training within industry or training on the job. This method of training was used to a considerable extent during the war years. Mr. Bleakley's list includes:

Trained within Industry	*Type of employment*	*Months of work*
1	Tapping machine operator	17
2	Tapping machine operator	17
3	Assembly	16
4	Operates drill press, turret lathe, milling machine, burring machine	22
5	Cup liner maker	22
6	Trucker	24
7	Drill press and inspection	7
8	General labor	7
9	Automobile mechanic	21
10	Bedspring assembler	18
11	Assembly	18
12	Paint dipping	13
13	Bedspring assembly	10
14	Assembler Box Co.	16
15	Assembler Box Co.	4
16	Brightwood machine operator Box Co.	5

These job placements follow the trend already noted in the list for blind trainees. Both lists suggest that blind persons can be trained to follow certain types of occupations, and that they can successfully pursue the occupation is shown by the months of continuous employment. The average number of months of employment for the training within industry group is 14.8.

In the pages to follow some of the techniques used in training the blind certain machine-shop operations will be described. Mr. Buerkle's contribution to the teaching techniques deserves commendation. In this work there was no precedent to follow, and it is not always easy to navigate an uncharted sea.

Fred Boland, retired director of Trade Training for the Pittsburgh Board of Education, thought that this material should be reported — hence this study.

Figure 1 shows some of the blind trainees at their machine stations in Schenley High School.

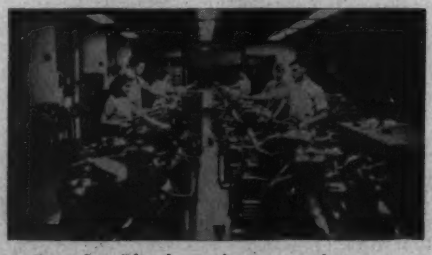


Fig. 1. Blind students working at the power tools

Teaching Techniques

Orientation. During the initial training period it is important that the blind trainee be given sufficient time to become thoroughly familiar with the machine. This is necessary, not only for his own protection, but also to safeguard the equipment. He should learn the name and position of the main parts of the lathe. Their functions should be made clear to him. The length of time devoted to orientation will depend to a large extent upon the ability of the particular student. Mr. R. E. Buerkle thought it desirable to spend approximately forty hours for this phase of the course. If the trainee happens to learn quickly, possibly a fourth of that time might be all that is necessary.

Such instruction will include changing speeds and feeds for the 13 in. South Bend Lathe. The r.p.m.'s for each cone pulley position and for both forward and back-gear speeds should be memorized. The learner then will be able to adjust the speed for a given size of material. In this connection, the use of the r.p.m. formula may be explained to the student. When he knows the size of stock he is going to machine he can adjust the belt to the proper cone pulley.

The blind student also spends time learning the use of the *apron* mechanism and how to engage the friction clutch for operating the power-driven longitudinal feed or the power-driven cross feed. He practices this at different speeds and at different feeds. Since the quick change gearbox has a wide range of feeds, the use of only a few of them is all that is necessary during the initial period of training. A *coarse feed* for roughing and a *fine feed* for finishing are probably sufficient. It is better to know a few well than many half-learned. When the trainee has learned to do these operations without having to grope to find the clutch he is ready to learn a new operation.

Changing Pulley Speeds. Figure 2 shows

Fig. 2. Changing pulley speeds

a trainee changing the position of the belt. When a lever, not shown, relieves the tension on the belt, the belt may be easily moved and reclamped at the desired pulley position. Such a method for changing speeds applies only to the South Bend Lathe. Other makes of lathes employ different methods, but whatever the method used the blind operator should learn it.

Mounting the Chuck. Figure 3 shows a blind student mounting a chuck. It should be made clear, that in training the visually handicapped person, no attempt was made to make it easy for him. Things were not done for him that he could learn to do for himself. The pitying attitude was sedulously avoided. It seemed the best policy to keep an open mind and not attempt to come to rash conclusions before first trying the operation out. The student, therefore, obtained his own tools from the toolroom. He told the toolroom attendant what tools were required, and he carried the necessary tools to his machine station. In the Schenley shop all chucks are kept in the toolroom until needed. So, in order to mount the chuck on the headstock spindle, each student first obtained it from the toolroom. If dust particles are lodged in the thread, he uses a spring thread cleaner to remove any grit which might cause the chuck to bind on the spindle thread. After a few drops of oil are placed on the spindle thread, the chuck is screwed up tight to the thread shoulder.

Setting Up the Tool. With the mounting of the chuck, or of a faceplate, the trainee is ready to start machining the job. If the work requires facing, he cuts the stock to the required length on a power hack saw. To do this he uses a sample job to obtain the correct sawed length, and so allows sufficient stock for facing. He then inserts the stock in the Universal chuck and allows the piece to extend the necessary distance before tightening the jaws with a chuck wrench. After he obtains a ground tool bit he tightens the bit in a toolholder, and then inserts

Fig. 3. Mounting the chuck

the toolholder and clamps it in the toolpost. To get the tool bit to the height of the tailstock dead center he uses his finger to feel the point or nose of the tool. When both points coincide he knows that his tool is adjusted to the proper height for cutting.

But in an operation such as facing the tool must be adjusted to give additional clearance. A sighted operator can determine the proper clearance by just looking, but a blind operator must do this by gauging the distance with his thumbnail. How this is managed is shown in Figure 4. When there is sufficient room for his thumbnail to slide in between the faceplate or chuck and the cutting edge of the tool he knows that the tool has sufficient clearance. It should be understood that the nose or point of the tool is just touching the faceplate.

Calipering the Work. In machine-shop work, as is well known, it is not enough to remove just any amount of metal. It must be removed down to a definite size. When it is remembered that removing metal to a specified tolerance taxes the skill of a sighted person the training of the blind individual seems an insurmountable task. But the devices long used in the machine-shop were employed. Such tools as templates, plug gauges, and spring calipers were invaluable. Suppose a shaft 1 in. in diameter has to be turned. The blind operator simply obtains a 1-in. plug gauge and, using his calipers as shown in Figure 5, finds the size. He keeps his calipers set, checking with the plug gauge occasionally until the shaft is turned to the

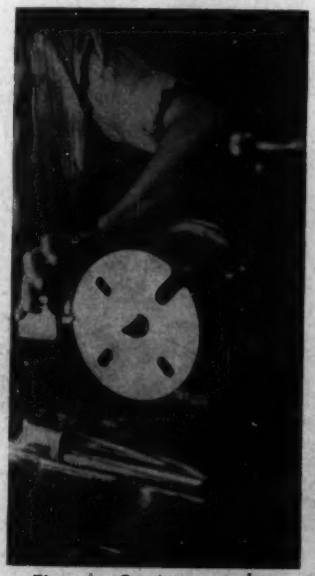


Fig. 4. Setting up the cutting tool

desired dimensions. If the shaft to be turned extended to a shoulder 4 in. from the end, a template 4 in. long could be used, or the dimensions could be transferred to inside calipers. When plug gauges are not available, calipering the size from a twist drill gives satisfactory results.

Fig. 5. Calipering the work

Transferring sizes from sample jobs is still another method employed. This method was adopted in the test job which the students machined to the test dimensions. The accuracy to which blind students can work will be discussed in a later section.

Position of Hand When Turning Shaft. Figure 6 illustrates the technique which the student uses in turning a shaft. The position of the operator's right hand should be noted. Here the operator is *feeling* the progress of the longitudinal cut as it progresses along the shaft. He can tell by the *feel* what kind of surface the tool is machining, and so can sense when the tool needs redressing. When turning to a shoulder, *feeling* the progress of the cut as it travels longitudinally enables the operator to tell when he must release the clutch on the longitudinal feed. As the cut approaches the shoulder the point of his finger can gauge how far the tool must travel to reach the shoulder, and at what point he must disengage the clutch lest the tool should plough into the shoulder and spoil the job.

Chasing a Standard Thread. The importance of maintaining an open mind as

Fig. 6. Position of hand when turning shaft

to what operations the blind can or cannot perform has been emphasized already. One such operation is threading. Sight is so invaluable for this particular operation that its lack poses definite problems that must be overcome. There is, first of all, the problem of setting the compound rest at 30 degrees from the perpendicular when threading a standard thread. In the second place, there is the problem of *catching the thread*. There is also the problem of disengaging the half-nut or split-nut lever when approaching a shoulder.

Obviously the simplest thread of all to chase could have been attempted. That is, one in which the pitch of the thread to be cut is an even multiple of the pitch on the lead screw. In this case, the split-nut lever may be engaged at any point as the carriage travels along the ways. It was thought, however, that only a typical job should be attempted, such as, threading a bolt, or threading a portion of a shaft up to a shoulder after the minor diameter of the thread had been undercut. It should be understood, too, that the blind operator is unable to *feel* the progress of the tool as in straight turning. With each succeeding cut the threading tool penetrates deeper into the work, and so the operator is unable to employ his feeling technique. He, therefore, has no means of knowing when to disengage the split-nut lever. It will now be easily seen from the foregoing discussion that, if the blind operator ever hoped to learn how to thread, additional aids were absolutely necessary.

Setting Compound Rest for Threading. Figure 7 illustrates how the blind operator

Fig. 7. Setting compound rest for threading

sets the compound rest to 30 deg. The operator is shown holding a small 30, 60-deg. triangle. It may be seen resting on the ledge of the compound. When the 90-deg. side of the triangle is brought in contact with the faceplate, the compound rest may be turned at will to the desired angle once the nuts are loosened. The compound is then clamped in position. The triangle may also be used to set the 60-deg. threading tool at right angles to the work. This device is used for setting the tool when the operator has difficulty using the regular center gauge.

Use of Tape Device for Threading Dial. The threading dial fixture enables the operator to *catch the thread.* (See Figure 8.) The threading dial is divided into eight divisions, four of them — the main

Fig. 8. Use of tape on threading dial

divisions — are stamped 1, 2, 3, and 4. Each one of the eight divisions represents a half inch of carriage travel, and the numbered divisions from 1 to 2 or from 3 to 4 represent one inch of carriage travel. When cutting an even number of threads per inch, say 10 threads per inch, or 12 threads per inch, etc., any one of the eight divisions may be used. But when cutting an odd number of threads per inch, such as, 11 threads per inch or 13 threads per inch the numbered divisions are used only. There is also a fixed line of reference stamped on the body supporting the dial. The dial is caused to rotate through a worm wheel which connects to the lead screw. When the split-nut lever is disengaged the dial rotates, and when it is desired to make a threading pass the split-nut lever is engaged just when a division on the revolving dial coincides with the fixed reference line. Failure to make the lines coincide before each pass will spoil the thread. It will now be easily seen how important it is to engage the split-nut lever at the proper moment. But how, then, can the blind person be taught to engage the half nut at the right moment? It was done by making use of a blind individual's sensitive tactile sense. The simple expedient of cutting small strips of band aids, which were available in the shop, solved the problem. The adhesive side enabled the piece to stick to the dial at the numbered divisions. Because both odd and even threads could be cut the numbered divisions were chosen. A thin strip of band aid was also attached to the fixed reference line. When the blind operator desired to engage the half nut he waited until the strip attached to the numbered division coincided with the fixed reference tape. The band-aid technique was not wholly satisfactory, because when oil accumulated on the dial the pieces of band aid moved out of alignment and caused work spoilage when not discovered in time. To obviate this difficulty better means may suggest themselves to the machine-shop instructor.

Use of Bell Attachment for Threading. Mention has been made already of the difficulty blind students encounter when they want to withdraw the tool at the right moment. In threading a job, for example a bolt, failure to remove the tool at the proper time will cause the point of the tool to break. Consequently, the trainee must be provided with a special attachment that will warn him at the exact moment the split nut should be disengaged. This device may be seen in Figure 9.

The attachment was designed by the writer for the 13-in. South Bend Lathe. The bell fixture was provided by William Miller, electric shop instructor, Turtle Creek High School. The attachment was so designed that it can be used at any point along the length of the ways and clamped in position. Attached to the fixture is an electric connection having a button. As the carriage moves along the ways it comes in contact with the button which it depresses slightly. As soon as the button is depressed it makes an electric contact which in turn rings a bell. At the moment the blind operator hears the bell he disengages the half nut and withdraws the tool. As soon as he returns the carriage, thus relieving pressure on the button, the bell stops ringing. He is now able to take succeeding cuts until the required depth of thread is obtained.

Some Machine-Shop Products. Figure 10 illustrates a few of the machine products produced by blind students. Some of the operations covered by such students are as follows:

1. Facing
2. Drilling with a twist drill in the lathe

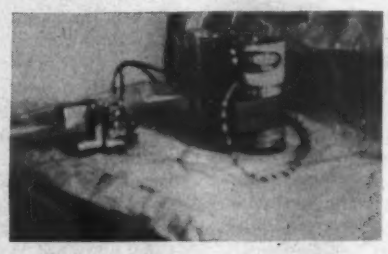


Fig. 9. Bell attachment for threading

3. Use of a parting tool
4. Boring
5. Straight turning
6. Turning to a shoulder
7. Knurling
8. Chasing outside standard threads as in a stud
9. Chasing inside thread such as a nut
10. A test job which includes threading

In addition to operating the lathe all the students learned to operate the power-driven hack saw. One student had some practice work on a shaper, and the same student performed simple operations on the horizontal milling machine. Another blind student cut an acceptable Acme thread having the same pitch as the lead screw. During the early part of the course a few students operated the drill press. Some of them had a little bench training assembling a carburetor.

It will have been noted that no mention is made of grinding tools. The omission of this operation does not mean that the students were unable to learn it. It simply means that the necessary techniques have

Fig. 10. Machine-shop products

not been developed. The discussion so far has suggested that before a student can learn a particular operation special fixtures may have to be designed. Inasmuch as the grinding wheel is hardly the machine to trifle with, it would have been foolhardy to attempt to teach the blind tool grinding without the necessary devices.

Safety. At first thought it might be imagined that the afore-mentioned handling of the work might lead to many cut fingers or to a serious accident. On the contrary, there were surprisingly few cut fingers. Only on a few occasions was a cut finger or a sliver lodging under the skin reported. In this respect, the blind are perhaps more *safety conscious* than are sighted workers. They apparently develop a sense which warns them of danger.

(To be continued)

MY KIND OF BOY

Leonard E. Schmidt*

You say you have a new boy for me?
A most remarkable lad?
You say that he's a "perfect gem,"
The best the school ever had?
That he's never missed a single day,
Or been late, or failed in an exam?
Then please don't send him into my shop,
Let someone else have him, "Yes Mam."

For me — I want a regular boy,
The kind that can make a mistake;
A boy who will skip school now and then
To fish, or to swim in the lake.
I never liked the angelic kind
Who never gets into a fight,
I'm afraid that someday he may choke himself
With a halo that's much too tight.

Send me the boy that nobody wants
Because he's not keen on books,
Or because he isn't the "goody" type
Or hasn't the nicest looks,
And he and I will get along fine
For I know the age old rule:
"To err is human" — and by the way —
I too used to play "hookey" from school.

*Lincoln Hall Vocational Shops, Lincolndale, N. Y.

Production Orders for the Vocational Shop

*Milo P. Johnson**

Production orders and time cards can be used effectively by the vocational shop teacher to instill within his students the value of time and material. Right from the first day the vocational students should be thinking of the items which they produce in terms of the number of man-hours spent on each item.

The students' work habits which were formed in school shops where time wasn't considered an important element, and where spoiled material was replaced for the asking, will have to be changed. Also to be changed is that habit of tinkering which some young men, and older ones, too, never seem to outgrow. The tinkering complex and any other habit or attitude that the student possesses which is a hindrance to his productive ability needs to be weeded out as early as possible in his course of training.

One of the best methods obtainable to

Fig. 1. Punching the time clock at California Polytechnic School helps teach this vocational student the value of time

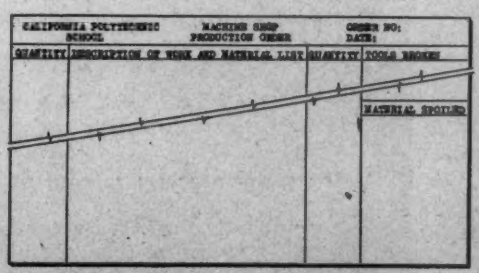
teach students the value of time is with the use of production orders and time cards. The only piece of equipment necessary is a recording time clock, which certainly is one of the most essential machines that can be found in any vocational shop. In conjunction with the time clock are used regular job cards with spaces arranged so that the student can punch in and out for each job. On the time card should be written the student's name and number, corresponding to his tool-check number. There should be space enough for a brief description of the job on which he is working and for the production order number. These time cards are the same as those used by industry and can be purchased from any office supply company. The production order forms can be made to good advantage on the school's mimeograph. See Figure 3. On the front of this form there is a space for the order number, for the quantity and description of the items to be produced, for the materials used, materials spoiled, and for the tools broken while producing the order. On the back of the order sheet there is a column for the number of each student who has worked on this order. Opposite it are placed the entries for each time the student worker has punched in on the job. At the end of these entries there is a column for the total hours of each worker. At the bottom of the sheet there is a space for the total man-hours that have been put in on the job. Then the final and the most important space is reserved for the average man-hour cost of each item produced.

These production orders may be used to cover almost every type of work that could be carried on in a vocational shop. If the items are to be produced in small production lots then the order is used to check the average man-hour cost per item. If single items are made, or repair work done, the order then shows the cost for setting up and doing that one job. In regular industrial shops it is the custom to have an order number for overhead time. In a school shop, it is necessary also to have an overhead order to which the student in the tool crib, and all who are doing non-productive work, can charge their time. When this overhead time is added up at the end of each month and shown to the class it helps them realize how large an item this overhead really is. It partly explains why there is such a variation, in a jobbing shop, between the productive worker's hourly wage and the charge made per man-hour. A close watch should be kept to see that students don't try to slip their excess production time onto the overhead job number.

There are several ways in which the valuable information that can be acquired on a completed production order sheet may be applied. The teacher should have a talk with the students and show them, according to the entries on the order, the exact time which they took to do the job. They are usually surprised. Their first question probably will be: how long should it have taken? This is the point at which the teacher's training, experience, and judgment is given a tough test. If the teacher has recently worked in a shop that is equipped similarly to the school, he can estimate from his own experience, or if advanced students have previously done the job in an accurate and speedy manner their time can be quoted. Considerable forethought should be given to the answering of this

Fig. 2. The tool-crib attendant is posting the time from the time card to the production order sheets

question. After the matter has been settled concerning the length of time that the students should have taken, the teacher can then point out the amount of material



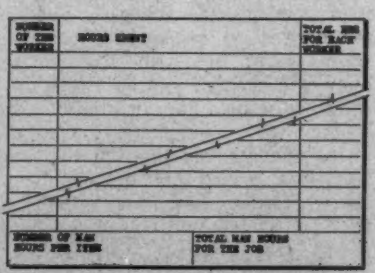


Fig. 3a (at left): The front of a sample production order sheet — original size, 7¼ by 5½ in. Fig. 3b (at right): The back of the production order sheet

*Vocational Machine Shop Teacher, California Polytechnic School, San Luis Obispo, Calif.

that has been spoiled and the tools, if any, that have been broken. At the end of the interview the order should be filed away so that the same students or student at a later date can be asked to repeat it. This comparison of man-hours and materials spoiled will be a good check on how the students are progressing. By carefully studying the results shown by these job orders the teacher has a valuable method of determining when the student worker can be recommended for a job in industry.

For the teachers who are willing to spend time getting this production order system started there are some real values to be gained. Not only is the problem settled concerning those who are fit for graduation but the teacher can feel assured that his students won't be fired because they aren't *time conscious*. When the young worker leaves a class that has been run on this basis and gets into industry, he won't be likely to use emery cloth where a gasket finish would be sufficient, or keep the tolerance within five ten-thousandths when a sixty-fourth would be good enough.

Students who are trained from the very beginning to revere the value of time and material will be much more likely, when they enter industry, to make a good name for themselves, their teacher, and their school.

Designing Industrial Arts and Vocational Education Shops and Classrooms

*H. W. Paine**

The following list of check points and reminders have been arranged for those who have to make the layouts for shops and related subjects classrooms for teaching industrial arts and vocational education classes.

Location Criteria

I. *Accessibility to groups served*
1. Day school patronage data
   a) Accessibility in light of present student distribution
   b) Accessibility in light of possible changes due to new location
   c) Transportation problems under (*a*) and (*b*)
      (1) Public transportation
      (2) Auto and private bus
2. Evening school patronage data
   a) to *c*) just outlined

II. *Nature and area of proposed school tract*
1. Topography, shape and area
2. Foundation and drainage problems
3. Grading and soil problems
4. Athletic field requirements
5. Parking problems in the area
6. Surroundings and environment
   a) Types of adjacent neighborhoods
   b) Traffic hazards
   c) Odors, smoke, noise, dust, etc.
7. Maintenance problems
8. Possibility of future expansion

Building Type and Shape

a) Number of stories
b) Material and construction
c) Shape of building

d) Entrances and fire escapes
e) Servicing facilities

Internal Details (General)

a) Corridors and hallways
b) Stairways, railings, etc.
c) Ability to isolate sections of building
   (1) For handling groups
   (2) For fire protection
d) Central location of auditorium, cafeteria, gymnasium, offices, band and music rooms
e) Shop wing locations (noisy shops farthest from classrooms, etc.)
f) Office arrangement
g) Faculty room
h) Flooring materials
   (1) Linoleum, tilatex, cement, etc.
i) Fire protection
j) Public-address and time-clock systems

Heating Systems

a) Flexibility
b) Economy of operation
c) Possibility of handling increased load
d) Variations for different shops and classrooms

Optimum Floor Size or Area for Shops

a) Number and kind of equipment and tools
b) Size and weight of equipment
c) Space between machines
d) Post spacing if another story above
e) Width of aisles
f) Toolroom space
g) Stock room space
   (1) Accessibility
   (2) Racking and storage provisions
h) Washroom
i) Shop conference room (size and location), (chairs, fixed or folding bleachers)
j) Shape and size of shop, balcony, etc.
k) Size and location of doors
l) Position and number of benches
m) Locker spaces
n) Space for instructor's filing cabinets, files, locker
o) Flooring materials (asphalt block, tilatex, wood block, wood, etc.)
p) Floor drainage

Shop Equipment and Arrangement

a) Names of machines
b) Number and position of machines (scale models)
c) Diagonal and straight arrangements
d) Number and location of benches
e) Location of portable equipment
   (1) Welding equipment
   (2) Demonstrating equipment
f) First-aid cabinet
g) Safety provisions
h) Wiring provisions
i) Ease of removing and rearranging equipment
j) Overhead tracks
k) Floor construction
   (1) Outlets for water or fumes

Shop Walls and Ceiling

a) Optimum ceiling height (check code)
b) Ceiling construction and height
c) Position and spacing of windows
d) Type of windows (check code)
e) Height of windows from floor
f) Finish of walls in shop and conference room
g) Blackboard space
h) Bulletin board (size and location)
i) Wall charts
j) Pictures
k) Codes
l) Wall construction
   (1) Materials
   (2) Removability
m) Air, gas, and electrical outlets

Toolroom, Tool Crib, or Tool Panels

a) Type: open or closed
b) Location for accessibility
c) Provisions for handling and checking tools
d) Provisions for identifying tools
e) Provisions for handling borrowed or loaned tools
f) Tool window arrangement
g) Toolroom service equipment
h) Finish

Shop Conference Room

a) Optimum size and location (main floor or balcony)
b) Equipment (chairs, tables, benches, etc.)
c) Demonstrating table or bench
d) Lockers, cabinets, etc.
e) Files, desks
f) Visibility
g) Acoustics
h) Heating and ventilating equipment
i) Possibility of folding bleachers instead of conference room
j) Provision for visual aids

Shop Heating and Ventilating

a) Types of heating and ventilating systems

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b) Advantages and disadvantages of each type
c) Choice of type with sound reasons
d) Relative costs of operation

Shop Lighting (For both shop and conference room)

a) Types and efficiency of electric lights
(1) Fluorescent, etc.
b) Window ratio (check code)
c) Sunlight
(1)Angle of light through windows
d) Shadows, glare, etc.
e) Position of lights with respect to machines
(1) Light line (9 ft.)
(2) Arrangement of lights
f) Number and location of wall plugs
g) Type and number of bench lights
h) Individual lighting for machines

Shop and Conference Room Painting and Decorating

a) Effect of color combinations on eyes
b) Working conditions
c) Reflection and glare
d) Smoke and fumes
e) Method and ease of cleaning
f) Machine colors
g) Aisle and work area indications
h) Safety indications

Related Classrooms

Optimum floor size or area for laboratories, drafting, math, science, and general subjects
a) Size of classes and work to be done
b) Types of chairs, desks, or tables most desirable for work
c) Age of students
d) Spacing of desks, tables, or chairs
e) Width and number of aisles
f) Type and finish of floor, asphalt, tilatex, linoleum
g) Floor areas for
(1) Laboratories
(2) Drafting rooms
(3) Mathematics rooms
(4) General subjects rooms
(5) Band, little theater, etc.
(*a*) Ampitheater seating

Related Room Equipment

a) Types of tables, desks, or chairs
(1) Tablet arm, long continuous, etc.
b) Arrangement of tables, desks, or chairs
(1) V shape for typewriting
(2) U shape
(3) Semicircular
(4) Circular
(5) Rectangular
(6) Tools or demonstrating equipment
(7) Filing cabinets, teacher's desk
(8) First-aid cabinet
(9) Library
(10) Provision for visual aids

Related Room Heating and Lighting

a) Types of heating systems
b) Location and source of heating units
c) Types and efficiency of artificial lighting systems
d) Location and number of lights for size and height of room
e) Location of windows, desks, tables, or chairs for most efficient lighting
f) Possibility of shadows and glare

Related Room Walls and Ceiling

a) Height of ceiling, material, finish
b) Type, number, and location of windows; distance from floor level
c) Spacing of windows (ratio-check code)
d) Acoustics (sound treatment)
e) Blackboard space
f) Bulletin board, wall charts, maps, pictures, etc.

Related Room Painting and Decorating

a) Effect of color combinations on eyestrain
b) Amount of artificial lighting needed on dark days
c) Reflection and glare
d) Ease of cleaning

Offset Lithography—Opportunity for Special Aptitudes

*Henry C. Latimer**

In some of the material published on the modern lithographic process and its various operations, confusion is caused by the inclusion of methods relating to stone lithography and hand transferring. The impression is given some people that the old traditional hand methods are largely involved, and that the offset process offers little to those selecting the graphic arts for their vocation. Yet a close look at present-day lithographic methods reveals that the process is as modern as color photography; that the old hand methods have been almost entirely replaced by photomechanical methods. Comparatively little hand transferring is now done in our country, and this for highly specialized work. Stone lithography is a thing of the past for commercial work.

Twenty-five years ago an offshoot of the Lithographers National Association was the establishment of the Lithographic Technical Foundation for the purpose of introducing scientific methods in place of those of custom and tradition. A research laboratory was established for this purpose at the University of Cincinnati where it has continued until last year when it was transferred to Chicago in order to co-ordinate its facilities with those of the Armour Research Foundation. The work of the foundation has introduced new methods and resulted in the manufacture of improved offset paper and inks, as well as better chemicals, and supplies. Today the lithographic process is a scientific chemical method of printing, using photographic techniques for making the press plates and employing the offset rotary press which will put half tones on any type of paper stock at greater speeds than is possible with the reciprocating typographic press.

Many students interested in making their living in some branch of the graphic arts will find offset lithography (the same as offset printing, photolithography, planography, etc., which are all lithographic processes) has a special appeal to them because they can apply special interests and skills which will be reflected in the results obtained and the pay received. Boys interested in photography fit naturally into the camera room. Here they may advance steadily until they are doing highly skilled photographic color separations. If a student has an eye for color tones and is artistic, he may gravitate toward color correcting on the film and thus into high pay brackets. A student interested in chemistry will find the platemaking department of a lithographic plant of particular interest to him. Here he will be working with the chemical reactions of light on light-sensitive plate coating solutions, and will produce the printing image on the press plate photographically. As he works into process color work he will use a photocomposing machine which will give register to 1/1000 of an inch for each color. Mechanically inclined students may find the pressroom of particular interest to them. Here they will be adjusting pressures and cylinder circumferences and may advance to the operation of a four-color offset press which will print a whole book in four colors on one sheet of paper, including the end papers and book jacket.

Today printing buyers are using lithography more than ever. The last (1939) U. S. Census of Manufacturers shows that although graphic arts dollar volume as a whole dropped off 20 per cent in the previous ten-year period, lithography increased 20 per cent. In 1943 the PIC Survey (General Printing Ink Corp.) showed that just as many printing buyers in New York area used offset lithography as used the letterpress process — 86 per cent for each. In the same year a nationwide survey made by the publication, *Reporter of Direct Mail Advertising*, showed that 80 per cent of the printing buyers used the offset process as well as other processes. As the Department of Commerce pointed out in the November issue of *Domestic Commerce*, lithography has revolutionized the production of children's picture books. Children's textbooks in full color on uncoated stock were found so effective that now these also are largely produced by lithography. Improved methods, materials, and equipment have all contributed to this rapid increase in the use of lithography in the ten years just passed. Continued research by both the foundation and private industry indicates still further important improvements ahead.

Yes, there is opportunity in lithography — its recent growth is just the beginning.

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Industrial Arts and Vocational Education

John J. Metz, Editor

A JOB FOR VOCATIONAL EDUCATION

Many worth-while teaching methods of various kinds were developed and used in training our armed forces. Many of these methods had been used before in different types of teaching situations, but under the special pressure of equipping millions of men with special skills and information to make efficient soldiers out of them, made the teaching problem quite different from what it is in the everyday school.

Many young men who had never had a job, suddenly found out, through their army training, that they had some mechanical ability. Some of these same young men were then hurriedly taught to teach others. With close supervision and hard work, some of these young teachers learned to do a pretty good job. One of them, who had been drafted into the army after having spent a year or two at a teacher-training school voiced the opinion that he had learned more in two weeks about teaching, at the field where he had been made an instructor, than he had in a semester at school.

Naturally, he forgot that what he brought along from the institution which he had attended formed a good background for the instruction he got in the army. He also forgot that at the teacher-training institution he was engaged in several subjects, and that in most instances he was not teaching at all. He forgot also that army discipline helps one concentrate on the job that is to be done, while the college student frequently spends more time on extra-curricular activities (whatever they may be) than on his studies.

Many of these young men will find that preparing for a trade or for the teaching profession cannot be done as simply and as quickly as it was done in the army. They will find that just as their life in the army was simplified in many cases to the merest essentials, so their duties and their fields of action were quite circumscribed.

This will cause some discontent in the minds of some of the returned veterans, and they will have to be set right. They will have to reconvert to the status of regular life with all its complexities, many of which will not lend themselves to the drastic short cuts that made some of the instructional methods used in the army seem so extraordinary.

All of these considerations should not prevent vocational teachers and teacher trainers from carefully studying the methods used by the army in its classrooms. We should make use of every possible thing that the army found useful in their instructional work. Some of their teaching aids may be beyond the financial reach of the shop teacher but he may be able to approximate some of the things that were found so useful in the schools of the armed forces.

The one thing that must not be forgotten is that the objectives set up for industrial arts and vocational education still hold. We cannot forget that it takes time to acquire skills and related knowledge. We must not forget that we are training youth for a life which they must lead, not to get the best of a human enemy, but to develop themselves into good American citizens. To do that we, the teachers, must study the best methods of educating human beings.

The armed forces used efficient teaching methods to train men for a narrow calling. Let's learn what we can from them so that perhaps we can do our job better but let us not forget that we have a larger and more embracing job to do than the army had.

A BIT OF WORTH-WHILE RESEARCH

Canvassing the activities of the students who have been graduated out of your school shop and school may present a real job but the outcome of such a study may be very valuable to you and your present and future students. These boys and girls who have been under your direction may be able to tell you many things that you can use in making your instruction more effective.

What are your former students doing with the things they learned in your classroom? Are they applying some of the things you taught them? Their answers will be different, of course, depending upon whether your subject is on the industrial arts or the vocational level. In any event, they can, if they are approached in the right manner, give you some very helpful information.

Supposing that these students all took industrial-arts work in your shop. Have they been able to make use of some of the things you taught them? Have your precepts and example prompted them to equip a home workshop? Have they essayed to make use of something they learned from you in making repairs in and around the home? Have they adopted one or the other phase of your shopwork as a hobby? This hobby work phase of the industrial-arts course should be especially emphasized, because hobby work is more than something to keep idle hands busy. It also keeps the brain occupied with something worth while, and incidentally, the boy who spends his time in the home workshop is rarely alone. He will quickly surround himself with like minded companions and thus make hobby work doubly enjoyable. He will form a nucleus, as it were, radiating about himself an aura of worth-while effort and accomplishment, and instill his enthusiasm into other companions making them partake of the wholesome effect that a hobby exerts on its devotees. He may even succeed in making his father a partner in the home workshop.

Some of these industrial-arts students of the past may be able to voice ideas which will help the teacher improve his course. These pupils of bygone days will not volunteer to give advice to the teacher but they may be glad to make suggestions if they are asked.

With vocational students the problem is somewhat different. After such a student has worked for some time at his trade, he may be able to make some very worth-while suggestions. Again, he will not do this voluntarily, but he will feel quite proud if his former teacher comes to him seeking advice.

The instructor who tries this method need not fear of losing prestige. On the contrary, he will make friends for himself, for the school, and for his course.

MORE DESIRABLE THAN HIGH GRADES

A survey by Dr. Frank Endicott, Placement Director at Northwestern University, shows that most employers emphasize personality traits more than high grades in choosing workers.

They want alert, dependable, and enthusiastic employees, workers who possess initiative, self-confidence, good humor, courtesy, good manners, and the ability to get along with others.

Are we overlooking some of these requirements in our vocational education courses?

Preparation for A Changing Vocational World

*Earl M. Bowler**

What a challenge the revolutionary advancements of an atomic age offer those responsible for preparing our young people for entrance into this changing vocational world! A long, highly mechanized war has dislocated large segments of our population. Supplying and transporting our armed forces placed unprecedented demands upon our civilian economy. As the demand for more and more equipment mounted, shifts in the population increased in intensity. While all this was happening, we learned that gadgets, heretofore unheard of, helped us shoot with more deadly accuracy. This brought about in a matter of months technological changes normally requiring the evolution of years.

The war and its concomitance has altered our civilian standard of living. Before we begin the job of restoring well-known deficiencies, we may well pause for a look at the human values involved. Are we busy preparing our young people for a world that will exist when they arrive at their then employable age? Are we presently training veterans in traditional occupations, with a lack of vision that belies our educational age? Are the occupations of tomorrow yet born, and in what proportions should we train for the specific jobs involved in these unborn occupations?

Vocational education should remain in its own groove, yet it should not be so rigid that it scores the bottom of the groove and transforms it into a rut. The need for unity between the various educational services was never greater, yet, outside forces tend to pull these services into separate orbits of their own. Let us examine the three "wage earning" services in the light of a changing vocational world.

Agriculture of the Future

Farm mechanization has permitted greater production with fewer people; yet, as our urban population grows we cannot expect an indefinite decline in our rural population. If, as specific figures of the Census Bureau indicate, there is one person on the farm for every six persons in the nation, the load each farmer must carry is on the increase. The farm population, we are told, has decreased 18 per cent since 1920, and during the recent war period the decline totaled 15 per cent. Either still greater mechanization will take place, more intensification will be practiced, or a back to the land movement should be started.

While a movement in all three directions seems logical at first glance, Secretary of Agriculture Anderson points out the incongruity of this idea. "We might as well realize," Mr. Anderson told the 1250 youthful delegates assembled at the National 4-H Club Congress in Chicago late last year, "that fewer farmers will produce all the food we need and there is an inevitable trend toward fewer, larger, and more efficient farms."

"This trend means," he continued, "that more farm youths must seek opportunities in industry and business." He judged 50 per cent of the young people now in rural homes must choose their lifework off the farm.

The American people must be fed — well fed — and half the world is looking to our table for the crumbs. Mechanization, intensification, and "depopulation" of our farms seems to be upon us. To keep ahead of this changing world, is the challenge thrown to the American farmer and to vocational training in agriculture. We must train farmers to operate under these new conditions or risk starvation at home and abroad.

Trade and Industrial Mobility

The movement of industrial concentration has been largely from the interior to our coastal towns. It is reliably reported that 82 metropolitan areas along the coasts have gained approximately 3½ million people. The south and west gained most, while the north and central states just about balanced loss against gain. Civilian migration, unlike that of the military, is considered relatively permanent.

The persistence of the critical housing situation in many cities points up rather clearly that this permanence of population growth is no guarantee of a ready solution to the problem arising from such growth. A score of cities are "bursting at the seams" after an initial extension to accommodate wartime expansion. These cities must farther expand their housing, transportation, educational, recreational, and sanitary facilities. Greater provision for an expanded employment program must be projected if chaos is to be avoided during periods of weakened economic activity.

Presently, however, the need for masons, carpenters, and other building trades craftsmen is acute. The expansion of services to handle the increased population in the 82 coastal cities mentioned gives some idea of the training potentialities in these fields. The demand for evening trade extension work should be lively for some years to come.

The training of apprentices is expanding under the favorable conditions set up by the G.I. Bill. Most apprentice contacts call for at least 144 hours of related technical training each year. Improved quality in courses is needed if this type of training is to grow apace with the completion of new indentures. Standardization of the instructional units on a national level merits consideration as a means to bring to a new level of attainment the future journeymen of the greatest mechanical era in the history of mankind. Vocational educators should attack the problems of related instruction with renewed vigor hoping to produce something genuinely satisfactory to all parties involved in the apprenticeship indenture.

Looking forward to a time when unemployment may again be a factor, the war-created migratory populations of newly born southern and western industrial centers will tax the vocational and other training facilities. Already, the return of G.I. Joe has many of the colleges crying "Uncle" as new hordes tax housing, laboratories, staff, and other facilities. The swing will swell from the townsman to the journeyman as the flush days of the war gradually dim. A Federalized Employment Service will continue to increase labor mobility, and the necessary shifts from areas of light demand to areas of heavy demand will give us a new concept of the fluidity of our labor force. Movements of this kind tend to step up the need for training in the semiskilled, skilled, technical lines.

The long-range plans of the United States Employment Service include the retention of the training specialists established during the war period. This arrangement will increase the demands upon vocational schools through the better co-ordination of employer needs with existing facilities. The War Training Program did much to convince employers of the ability of the schools to assist them with their staffing problems. Many states are finding that there is more demand for their vocational training services than their state and federal funds will stand. The swift influx of workers and an attendant demand for an increase in training does not bring with it the necessary funds to provide seriously needed training programs which would take some of the "growth" out of the migratory category.

The Hazards of Business

Of the three million business organizations in the United States, more than 92 per cent can be classified as small. A small business is one employing 100 or fewer employees. This means that 92 out of every

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100 manufacturing establishments can be classified as small. In the field of distribution, 96 out of every 100 establishments employ fewer than 20 employees.

Many veterans have expressed an interest in setting up a small business. Does this represent a wise choice in a changing world? Possibly, the answer lies in the statement made by a Department of Commerce official: *"You stand a 50-50 chance to fail during the first two years."* In prosperous times nearly half a million business establishments fail each year.

If rated with the lucky 50 per cent that pull through these first two years, what are the chances for a quick cleanup? It has been estimated that just prior to the war there were approximately two million retail stores in the United States. The average of these two million stores have a total volume of sales of $23,750 annually. The daily "take" therefore would be about $76. Assuming the gross margin of profit to be about 20 per cent, the yield in round numbers would be roughly $15.20, daily. The net profit would be about 5 per cent, or just under $4. Hardly a get-rich-quick proposition.

These facts seem to indicate that owning a business is a rather hazardous undertaking to say the least. There are those who feel that in the years ahead, the safest place to earn a living will be on someone's pay roll. Certainly this will be true of those who have no previous experience in the distribution field. Owning a retail establishment means, not only selling, but buying, pricing, displaying, advertising, bookkeeping, and understanding human relations problems.

Today, preparation for a changing vocational world is like getting in on the upward swing of the stock market. Expansion in all categories will be upward and outward. One may enter almost any chosen field for success. Certain occupations, like certain stocks, will outperform others on a short-term basis. Those interested in the long-pull will do well, however, to tie to something fundamentally sound and be content to make progress slowly. Time has proved there are few short cuts on the road to success. The pathway from vocational training, to apprenticeship, to journeymanship is one sure route to adequate preparation. It is time tested, a route likely to pay off satisfactorily for the average American in this ever changing mechanical era in which we are living at present.

Co-operative Education Needs Publicity

*Donald K. Beckley**

"Co-operative plans should have more publicity, so that the employers would know what the schools are doing and the purposes for which the students are being trained."

Thus wrote one of the graduates of our department of retailing recently, commenting on the co-operative plan as she remembered it. Clearly, there is much lack of understanding on the part of employers as well as parents and prospective students as to the nature of co-operative education and the reasons why it could meet their particular needs.

The job of publicizing co-operative programs logically falls to educational people. It is not reasonable to expect employers or parents to read the many articles on this subject in the educational press, nor always to take the initiative in making inquiries about the nature of co-operative work. It is our responsibility to present co-operative education to them, and this article has been written to suggest several methods of accomplishing this task.

Explaining Program Variations

It is important to make clear from the start in publicizing co-operative programs that these plans may differ in a wide variety of respects. Retail training is a good example of this point. Retailing may be studied at several educational levels in various institutions: in senior high schools, in colleges, and in graduate schools to which a college degree is necessary for admission. On each of these levels there is a wide difference in the amount and the quality of the retail training given. Young people, ranging in age from 16 to 18 in high schools and 21 to 25 and over in graduate schools, are taking courses in this field and working some part of their time in retail stores. The classwork given to these students ranges from a single course in salesmanship to a three-year sequence of 15 or more specialized courses in the various functions and practices of the field.

In the various work arrangements also, these institutions differ widely. Some school programs may make students available for work only on Saturdays, or during a week or two of the Christmas season. One plan provides for work every afternoon and all day Saturday, with students free for full-time employment between Thanksgiving and Christmas. In another case, students may work two full days each week, attending classes on the other days. There are a number of variations possible in the plans commonly in use, and there is also the alternating block system, under which students attend classes ranging from one to ten weeks each. The situation in many other areas of co-operation is much the same as to the diversity of plans.

Retailing students study store training procedures

It is by no means suggested that these plans could be standardized, for clearly no one plan could meet all requirements. It is important, however, that employers and students as well be made to see how the plan in use by one school differs from others, so that no more than reasonable demands will be made of the students concerned. Obviously, an employer might reasonably expect better work from a co-operative student who worked every afternoon or on an alternating block plan than from a student who worked only a few Saturdays. If the employer does not realize the distinctions between the various programs however, he may not be entirely fair in making judgments regarding the relative abilities of the students from different schools, and he may not be accurate in judging the effectiveness of one program as compared with another. Thus in using the term *co-operative program* in conversations with employers, it would be highly desirable to make clear the extent of the work to be done co-operatively, and the educational level of the classwork.

Conducting Conferences for Employers

Another means of publicizing a co-operative plan which has proved effective is through conducting a series of conferences for executives of stores employing co-operative students. As one step in making co-operative employers more fully aware of

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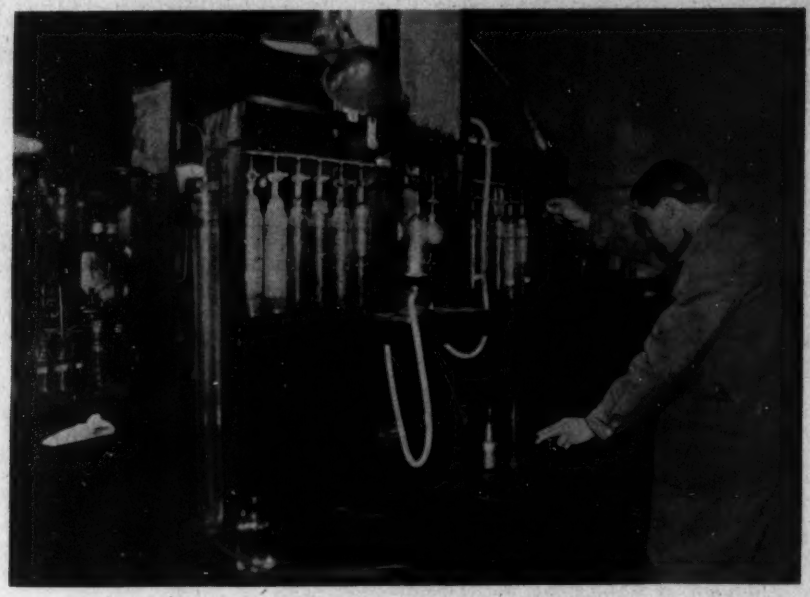

Co-operative students using modified Williams gas analysis apparatus designed by Rochester Gas and Electric Corporation

the institute and of the co-operative students they were employing, a semiannual conference for store personnel executives in western New York was instituted five years ago. This conference extends over a full day, with morning and afternoon sessions devoted to a round-table discussion of questions submitted in advance by those who attend. All of the necessary correspondence and preparation of minutes is handled by the institute, but otherwise the conduct of the meetings is entirely in the hands of the executives who attend.

The attendance at these meetings has been gratifying, and gives us reason to feel that they are meeting a definite need. At the first conference held in 1941 there were 13 executives here from 4 cities in this area. At the most recent conference there were 38 executives representing 23 department and specialty stores from 8 cities. There are various categories of executive personnel in all fields for whom conferences of this nature could be held to advantage.

Arousing Interest in the Field

In many areas of co-operative education there exists an unfortunate lack of knowledge and interest on the part of parents and the prospective students themselves. In most cases this attitude is the result of a lack of information as to the job opportunities in the field, or a failure to recognize the desirability of training in the field before attempting to secure full-time employment. In this area also there is much that can be done by co-operative educators to publicize and popularize their programs. Some methods which have been used to advantage are these:

1. Preparing descriptive illustrated booklets on the nature of and opportunities in the job field for which co-operative training is offered. Such booklets can be distributed to prospective students and to their parents through the schools or even through the industries or stores concerned.

2. Inviting high school administrators and counselors to meetings or conducted tours in which the educational facilities of the program are described, and the desirability of the job field stressed. Often high school counselors do not recommend a particular line of work because they are not fully aware of the job possibilities which it might offer.

3. Preparing articles — preferably illustrated — for publication in school periodicals and local newspapers. Photographs of co-operative students at work usually prove to be of considerable interest to other students and parents.

4. Taking motion pictures of co-operative students on the job, to be shown to parents and prospective students.

5. Having talks given by supervisors and instructors in the co-operative program to P.T.A. groups and other gatherings of parents and prospective students.

If the stores or industrial concerns can be made to see the desirability of having a larger number of students enrolled in courses training for their job field, it is then possible to secure promotional aid through them. If personnel people can see the wisdom of recommending that part-time workers eager for promotion take courses in that field, or that job applicants who do not have all of the necessary job qualifications look into the possibility of enrolling in the co-operative course, a considerable source of additional applicants can be made available. With a larger group of prospective students from whom to select, a higher set of standards for admission can be required.

It is the job of the workers in co-operative education to make their programs known about and appreciated. These are a few of the many methods by which this vital task can be accomplished.

Problems and Projects

USING THE MILLING MACHINE AS A SURFACE GRINDER

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A surface grinder is an expensive machine tool and is not always available to the partly equipped or small machine shop. Such a tool costs around $1,500. However, the work that it does makes it very desirable. That desire or need may be easily fulfilled by adapting the milling machine for use as a surface grinder. Even a small shop generally has at least one miller.

To arrange a milling machine so that it may be used as a grinder, it is necessary to have a tool post grinder. There are several makes on the market and they sell for about $100. This is usually a part of the equipment of the small shop because the lack of a surface or cylindrical grinder makes it essential.

Figure 1 shows how the grinder unit is mounted on the milling machine. The machine shown is a standard horizontal, universal mill of average size. The size doesn't matter for it could be put on any mill, even on a vertical.

The only addition to your equipment that must be made is the arm or adapter that holds the grinder.

In this setup this part is made from a junk automobile axle shaft. Such auto parts are very strong, rigid, and durable. The shafts may be found at any secondhand car-parts dealer. The shaft comes with the wheel flange that is already drilled. In this case it was cut to a convenient length, that is, a length that will put the grinder low enough to clear the overarm of the milling machine. The yoke at the bottom end, for the grinder clamp, was made by first milling each side of the shaft flat for about three inches from the end. Then a hole was drilled to make a neat radius at the end of the slot and the balance of the metal drilled and milled out. There

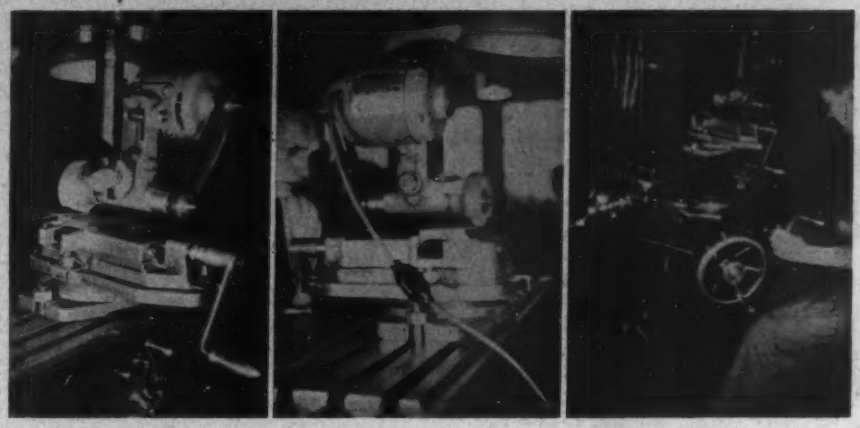

Fig. 1. The milling machine converted into a grinder

were already six holes in the flange of the shaft so two of them were re-drilled to three quarters of an inch for the hanger bolts.

The overarm of the milling machine shown is provided with two inverted *T* slots into which the hanger bolts easily fit. The slots are the same size as those in the mill table so *T* bolts were available.

Many milling machines have a single or a double overarm with round cross sections. For this type the adapter shaft must have a different clamping device to mount it. This will be as easy to make as the one shown and is just as good. When the mill has a single round overarm a heavy ⅝-in. *U* bolt will serve perfectly when used with the shaft shown. This bolt would take the place of the two *T* bolts. When there is a pair of overarms, two ⅓ by 1½-in. flat steel straps are laid across the top of the arms. Five eighths inch studs are put into these and into the shaft flange.

Rigidity can't be stressed too much in any type of mounting for the surface grinder. This is absolutely necessary to insure smooth, accurate grinding. Any milling machine makes a fine, solid base so if the mounting is solid the results will be excellent. A safety guard covering the motor belt, while not shown in Figure 1, may be readily improvised.

While being used the operator sits in front of the milling machine where he may easily reach the cross-feed hand wheel and the table feed control levers. The feed gears are set in the highest speed. The work to be ground is placed in the regular milling machine vise on parallels as shown, or clamped to the table, to an angle plate, to a *V* block, or in any way required for a given job. The operator sets the depth of the cut by use of the knee elevating hand wheel. The grinder and mill are started. The table feed lever is engaged. The feed reverse lever is held in one hand and the cross-feed hand wheel in the other. The work travels under the grinding wheel and is permitted to go about a half inch beyond the wheel, the feed is reversed, and at the same time the cross-feed hand wheel is rotated one quarter turn. This procedure is repeated until the entire surface of the work piece has been covered. When necessary more cuts are taken until finished.

It will be found that a grinder of this type will take a cut of about five one thousandths of an inch. That would be a roughing cut. In obtaining a fine, smooth finish a cut of about one thousandth should be taken and then go over the work once more without setting the cut any deeper at all. This puts a final extremely light cut on the job and results in perfection.

A TAILSTOCK-SPINDLE STOP

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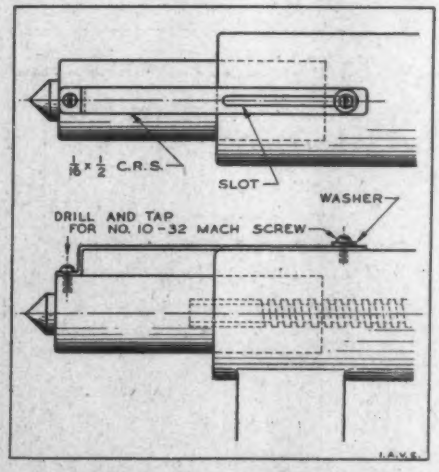
High School of Science

The Bronx, New York City

Wherever metal-turning or wood-turning lathes are present in a school shop the trouble is encountered that students turn handles and cranks when there is no reason for it. When the tailstock-spindle is turned long enough, the spindle leaves the thread which moves it out and in. The spindle then usually leaves the key which prevents it from turning, as well. Replacing the spindle in tailstock then becomes a time-consuming job. Besides this, the threads and keyway become burred after a while, and this makes matters worse.

After trying various schemes to prevent turning the spindle too far out of the tailstock, the following method was evolved which does the job very effectively.

A piece of 1/16 by ½-in. cold rolled steel was bent to the shape indicated in the illustration. One end is drilled while the other end is slotted. The slotting is accomplished by drilling, cold chiseling, and filing. The tailstock spindle is then drilled and tapped for a 10-32 roundhead machine screw about ¼ in. from the left end. Run out the spindle as far as you wish, being careful not to disengage the threaded parts inside. Then drill and tap a hole in the tailstock at the right end of the slot in the bent piece of cold rolled steel. Place a washer under the machine screw head which rides over the slot, and the stop is ready to do its duty whenever it is necessary.



This simple scheme provides sufficient spindle adjustment and prevents the running out of the spindle too far

LOW SPEED DEMONSTRATION MOTOR

JOSEPH J. LUKOWITZ

Brown Street School

Milwaukee, Wis.

Figure 1 illustrates a low-speed demonstration motor. The construction is exceedingly simple and the motor can be successfully used in school shops, science, and physics laboratories to illustrate effectively the principles of operation of a series electric motor. This is a universal motor — that is, it will run on either a.c. or d.c. electricity. This motor can be run at various speeds but its value lies in its slow motion, about 40 r.p.m., which makes it possible for the pupils to read the polarity labels as the armature revolves slowly. The fact that the polarity labels can be read as the armature revolves means little unless the polarity of the field poles and the armature poles is actually tested by the pupils and then labeled as indicated by the compass test.

The motor is so constructed that its principal parts, the field, armature, and brushes, can be almost instantly removed for inspection or study. This feature makes it possible to determine the polarity of the field poles by removing the armature and connecting a source of d.c. electricity to the field coil. When making this test be sure that the current is going through the coil in the direction it will go when the motor is assembled ready to run. The field poles polarity can be determined with a compass as shown in Figure 2. The poles may be labeled N and S by slipping the correct label in the label holders soldered to the field poles. Affix only two labels, one on the outside of one pole and one on the inside of the other pole. See Figure 2. Three or four No. 6 dry cells will supply the current needed.

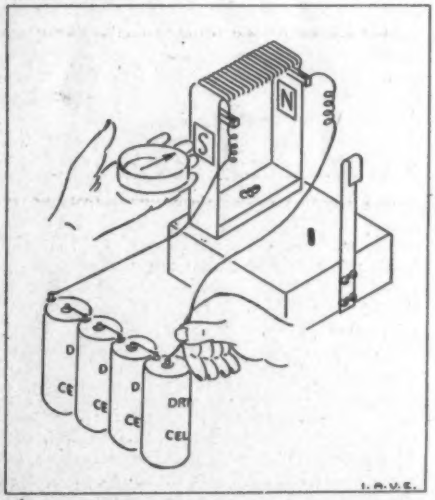


Fig. 2. Determining polarity of field

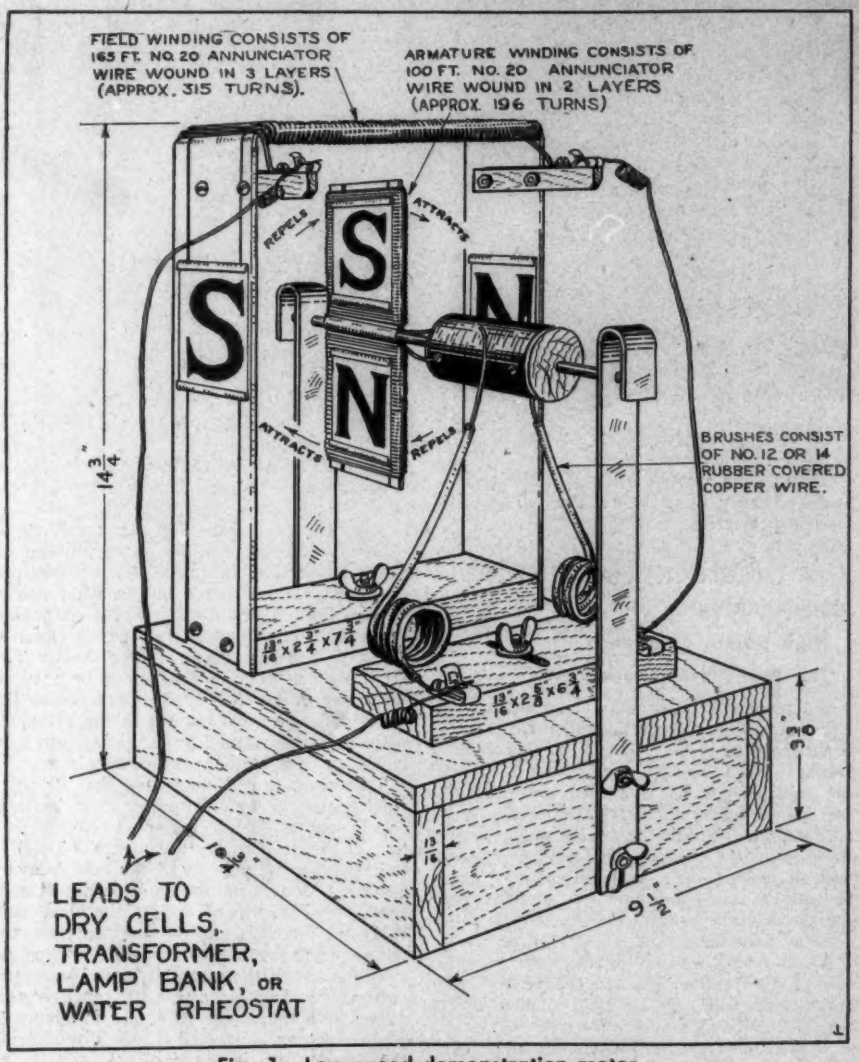

FIELD WINDING CONSISTS OF 165 FT. NO. 20 ANNUNCIATOR WIRE WOUND IN 3 LAYERS (APPROX. 315 TURNS).
ARMATURE WINDING CONSISTS OF 100 FT. NO. 20 ANNUNCIATOR WIRE WOUND IN 2 LAYERS (APPROX. 196 TURNS)
REPELS
ATTRACTS
ATTRACTS
REPELS
S
S
N
N
BRUSHES CONSIST OF NO. 12 OR 14 RUBBER COVERED COPPER WIRE.
14 3/4"
9 1/2"
LEADS TO DRY CELLS, TRANSFORMER, LAMP BANK, OR WATER RHEOSTAT

Fig. 1. Low speed demonstration motor

In a similar manner the polarity of the armature poles can be determined. See Figure 3. Be sure that the armature is in a vertical position when testing the polarity to preclude the possibility of the brushes contacting both segments of the commutator at the same time at the change-over point, thus shorting out the armature and failing to get a polarity indication from the compass. Next, without moving the armature move the compass to the lower pole of the armature and get the polarity for this pole from the compass. This, of course, would be the pole opposite to the first tested, but it is well to actually have the pupils test both poles and thus see that the labels really mean something. Label both poles with the correct labels. These labels should be located on one side of the armature; that is, so that they can both be read without turning the armature, as shown in Figure 3. Your labels will not necessarily correspond with these because your windings or connections may be the reverse of those used in the illustrations. The idea is to have the four labels, two on the field, and two on the armature, so placed that all four can be read from one side of the motor.

Now give the armature ½ turn and note the polarity reading of each pole by means

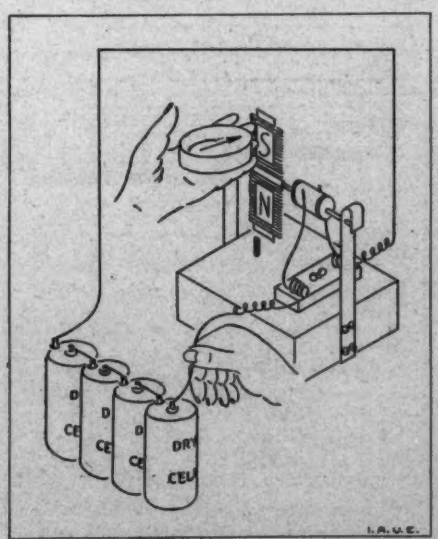


Fig. 3. Determining polarity of armature

of the compass. The polarity of the armature will be found to remain the same — that is, the upper pole will always be N or S depending on how the brushes are connected to the dry cells and the direction of the armature winding. Slip the correct label in the remaining two label holders on the armature. Do not remove the other two labels previously attached to the armature.

When correctly labeled the armature will have two labels on one pole, an N on one side of the winding and an S on the other side of the winding. These two labels will be placed back to back in effect. The other armature pole will also have two labels on its winding, an S on one side and an N on the other.

With field and armature poles thus labeled the motor may be set together taking care to make the connections properly so that the polarity indicated by the labels will be obtained. Caution: Remember that if either the brush or field connections are the reverse of those used when the polarity tests were made the motor will run but the labeling will be wrong.

The motor may be operated with dry cells, a lamp bank on 110 volts by using a total of 120 to 140 watt lamps in series with the motor. A transformer, about 24 to 30 volts or a water rheostat may also be used to operate the motor. For testing polarity of field or armature only direct current may be used. Lubricate the bearings with thin oil.

Of course, the motor action is a little different when using a.c. but the labeling is correct because the current reversals produce uniform changes in polarity and the action is as indicated by the labels. However, if after testing polarity and labeling the poles the motor runs in the opposite direction on a.c., reverse the brush connections and then the motor will run in the direction which the labels indicate.

It is necessary for all persons studying the motor in action to view the motor from the front, back, or side. See Figure 4. Stations 1, 2, or 3 should not be used as viewpoints. The side to be used as a viewpoint is determined by the side on which the labels have been affixed to the field poles. If for any reason it is desired to use the other side of the motor as a viewpoint it is merely necessary to shift the labels to the other two label holders provided on the field. The labels on the armature, however, will have to be changed about as follows: With the armature in the vertical position interchange the two labels on the upper pole. The two labels on the lower pole must also be interchanged.

As the motor slowly revolves the students should be told to focus their gaze on the S pole of the field and the S pole of the armature and to exclude all other labels from sight and consideration. They should then be told to analyze this action which is repulsion. Since the armature is free to move it turns. Now they should be told to focus their gaze on the S pole of the field and the N pole of the armature and exclude all other labels from sight and consideration. They should then be told to analyze this action which is attraction. Next, have them focus their gaze on the N pole of the field and the N pole of the armature and exclude all other labels from sight and consideration. They should then be told to analyze this action which is repulsion. Next have them focus their attention on the N pole of the field and the S pole of the armature and analyze this action. Since the poles have been tested with a compass

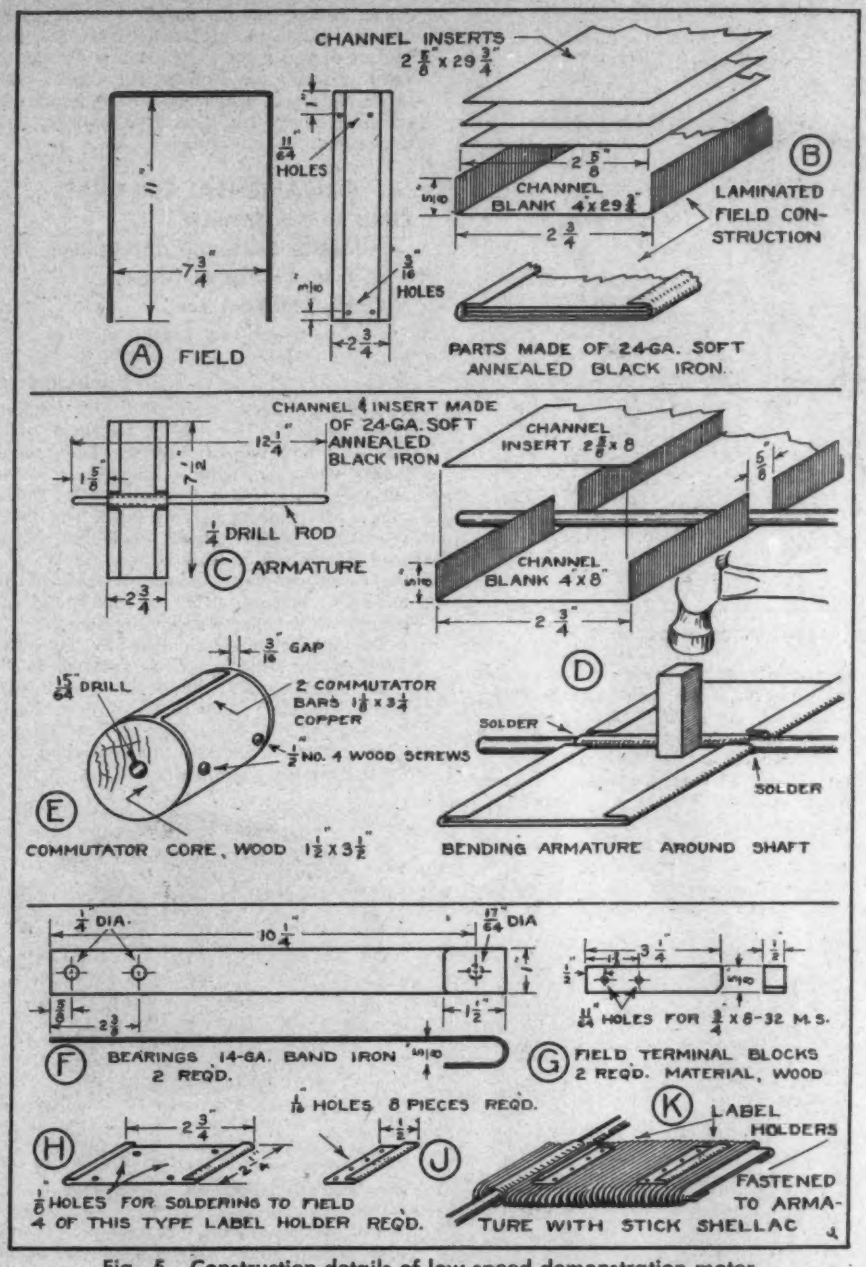

CHANNEL INSERTS
HOLES
CHANNEL BLANK 4 x 29 3/4
LAMINATED FIELD CONSTRUCTION
HOLES
A FIELD
PARTS MADE OF 24-GA. SOFT ANNEALED BLACK IRON.
CHANNEL INSERT MADE OF 24-GA. SOFT ANNEALED BLACK IRON
CHANNEL INSERT 2 5/8 x 8
1/4 DRILL ROD
C ARMATURE
CHANNEL BLANK 4 x 8
GAP
DRILL
2 COMMUTATOR BARS 1 1/8 x 3 1/4 COPPER
No. 4 WOOD SCREWS
SOLDER
SOLDER
E
COMMUTATOR CORE, WOOD 1 1/2 x 3 1/2
BENDING ARMATURE AROUND SHAFT
DIA.
DIA
HOLES FOR 3/4 x 8-32 M.S.
F BEARINGS 14-GA. BAND IRON 2 REQD.
G FIELD TERMINAL BLOCKS 2 REQD. MATERIAL, WOOD
HOLES 8 PIECES REQD.
K LABEL HOLDERS
H
J
HOLES FOR SOLDERING TO FIELD 4 OF THIS TYPE LABEL HOLDER REQD.
FASTENED TO ARMATURE WITH STICK SHELLAC

Fig. 5. Construction details of low speed demonstration motor

the student knows that the labels really indicate the true polarity of the poles of the motor and this makes the motor action, or the reason for it, clear and simple and graphic.

It is extremely important to consider separately the action of one field pole and one armature pole on each other. Any attempt to watch all labels at once will result in confusion even in this slow-speed motor.

If the motor revolves too rapidly on, say 4 dry cells, and does not run on 3 cells, use 4 cells and increase the brush tension to retard speed of rotation. If any difficulty is encountered in throttling the speed with lamp bank operation decrease the total wattage of lamps used or increase the brush tension or both.

Method of Construction

Base: The construction of the base is simple box construction as illustrated in Figure 1. The six ¼ by 2-in. r.h. stove bolts in the base are turned into 7/32-in. holes so that they remain in the base as the different parts of the motor are assembled or disassembled. When locating the bearing-support stove-bolt holes, first drill the holes in the bearing supports and then clamp them to the base. Slip the armature shaft in the bearings and adjust them so that the armature is centered properly in relation to the field. Be sure that the armature revolves freely and does not stick in bearings that may be out of line. While the bearing supports are clamped in place drill the holes for the bolts in the wood base.

Field: The field construction is shown at A and B in Figure 5. The laminated construction is not necessary, but it makes it possible to do the cutting of the material with tin snips. If one-piece construction is to be used, 14-ga. soft iron will do. The winding is put on in three layers. See Figure 1. Insulate the field with a layer of friction tape before winding. The direction of winding is immaterial and a few turns more or less will not matter. Shellac each layer and when the winding is finished give the winding several coats of shellac. The field terminals are connected to clips fastened to wooden terminal blocks dimensioned at G in Figure 5.

Field Label Holders: The label holders for the field are made of tin cut from a tin can. See H, Figure 5. Remember that four label holders are made for the field but only two are used in any one demonstration.

Armature: At D, in Figure 5, is shown how the shaft is slipped between the two pieces of armature iron and how the iron is hammered around the shaft. Use a square to set the shaft square with the armature. Final bending of armature leaves around shaft may be done by clamping in a vise. Notice that the armature blank is dimensioned ½ in. longer than the finished armature shown at C in Figure 5. After the shaft is soldered in position, cut the armature to finished length by measuring from center of shaft to ends. Cut both ends and file to perfect balance. Have the clearance between armature and field ⅛ in. at each end. Insulate the armature with a layer of friction tape, and put on the winding in two layers. See Figure 1. For the first layer start winding at the shaft and wind 50 turns out toward the end of the armature. Then wind a second layer of 48 turns on top of this layer. Next wind 50 layers on the other end of the armature. Then wind 48 layers on top of this, thus finishing the winding at the shaft. It is essential to have the same number of turns on each side of the shaft to maintain balance. Shellac the first layer of wire and when the winding is finished give the entire winding several coats of shellac. If the armature is unbalanced after winding, slip a piece of sheet metal wrapped with friction tape between the layers of the winding at the light end.

Armature Label Holders: The label holders for the armature are shown at J in Figure 5. They are held in position by first melting stick shellac on the armature winding at the point where the holders are to be set. Place the holders on the shellac and then apply a hot soldering iron or other hot iron to the holder. The heat will melt the stick shellac which will flow into the holes provided in the

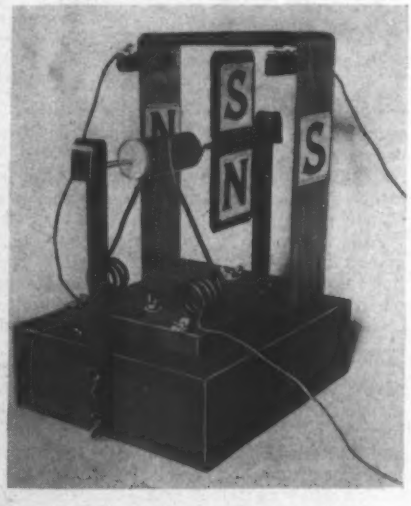


Fig. 6. Demonstration motor

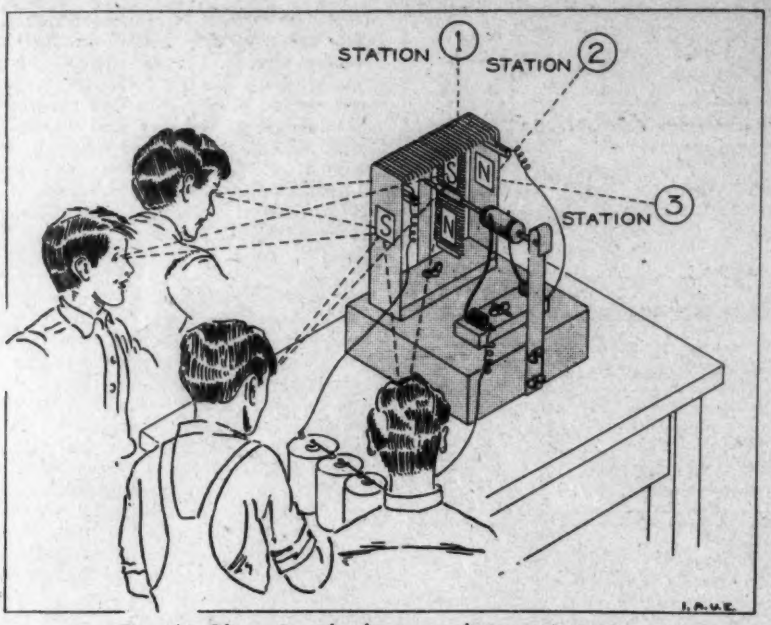


Fig. 4. Observing the low speed motor in action

holder, thus holding it in place. Rubber bands could be used instead of these label holders on the armature.

Commutator: The commutator construction is shown at E in Figure 5. Bend the commutator bars to fit a cylinder about 1¼ in. in diameter. Then when they are fastened to the 1½-in. diameter commutator core they will spring out and be held firmly in position by the two wood screws. Be sure the wood screws do not touch the shaft or a short will result. The hole for the shaft in the commutator core should be less than ¼ in. to allow a tight fit. Be careful not to bend the shaft when driving the core on.

Brushes: The brushes are made of No. 12 or 14 rubber covered copper wire. To obtain a slight spring action make four turns or loops about 1 in. in diameter, at one end of each brush.

INTRODUCING A COURSE IN ART-METAL WORK

CARLYLE H. SMITH

Jr.-Sr. High School

Princeton, N. J.

For over 40 years art-metal work has proved a popular and valuable subject in every industrial-arts setup where it has been properly introduced. As a shop subject it teaches the use of fine tools plus the development of skill in workmanship and the creation of good design.

Art-metal work as a subject was introduced in our industrial-arts setup this year and although certain tools were not available the quality of the work produced with limited tools gives every indication that the work in this field will be of high caliber.

The accompanying illustrations show some of the work done the first term with limited equipment by a group of freshmen boys meeting one period per day. As more equipment and materials become available the course will be expanded to include jewelry work.

Too much cannot be said about the finishing of work completed. Various finishes can be applied for the most satisfactory effect, but whatever is applied should be done with great care. As strange as it seems a great many instructors will have a boy spend hours finishing a project of wood but think a few minutes are all that is necessary to spend on metal projects. Finishing is important and unless an instructor knows his metal finishes it would be better if he did not attempt the work at all as the results are sure to be far from satisfactory. On the other hand, if a project made of metal, whether it be made of copper, brass, pewter, or silver, is properly finished, it is a piece of real beauty and the student derives great satisfaction and pleasure when he sees a piece of flat dull copper take shape under his hands and finally become a gleaming candy dish, a set of book ends, or a candlestick.

Art-metal work made by the students of the junior-senior high school, Princeton, N. J.

ORNAMENTAL TIN CRAFT

CHRIS H. GRONEMAN

Industrial Education Department

A. & M. College of Texas

College Station, Tex.

(Continued from page 141 of the March, 1946, issue)

Candleholder

With carefulness in forming and building, the candleholder becomes a treasured ornament for any fireplace mantel. The candleholder shown in Figure 1 has been given an antique copper finish which is quite appropriate for projects of this type. The finish resembles a copper object which has weathered many years and has become tarnished as the result of time. Articles finished in this manner command elaborate prices and are popular with ladies who love antiques.

The making of the candleholder, layout B, involves the making of a grooved folded seam, which requires the blank shown in Figure 2. The main body of the project should be made of two thicknesses of sheet tin and may be formed similarly to the method used for making trays and plates.

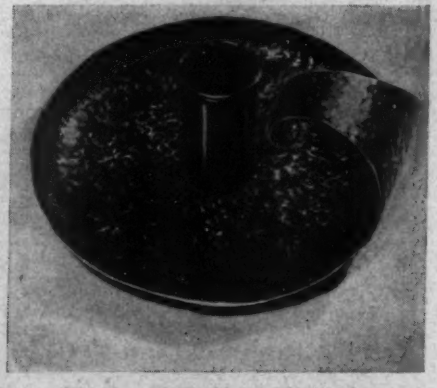


Fig. 1. A simple candleholder

The process of antiquing is simple. Dissolve a lump of liver of sulphur (this can be obtained in most drugstores) about the size of the thumb in a can or bucket of boiling water (2 gallons). Allow about three minutes for the chemical to dissolve and immerse the copperplated object into the water solution with a string or wire. Do not allow the project to remain in the solution too long because the color action is almost immediate. Lift the candleholder to check on the color and again immerse if necessary. The color should be dark brown with a lavender hue. When the desired color is obtained, immerse the project in a container of cold water to check the action. After the project has dried, high light the surfaces with steel wool; this will put a bright finish to the high places and leave the indentations dark. This gives the desired antique finish which can be retained by the usual application of clear metal lacquer. It is suggested that the beginner experiment with several pieces of scrap metal before attempting to put this finish on any project. The usual

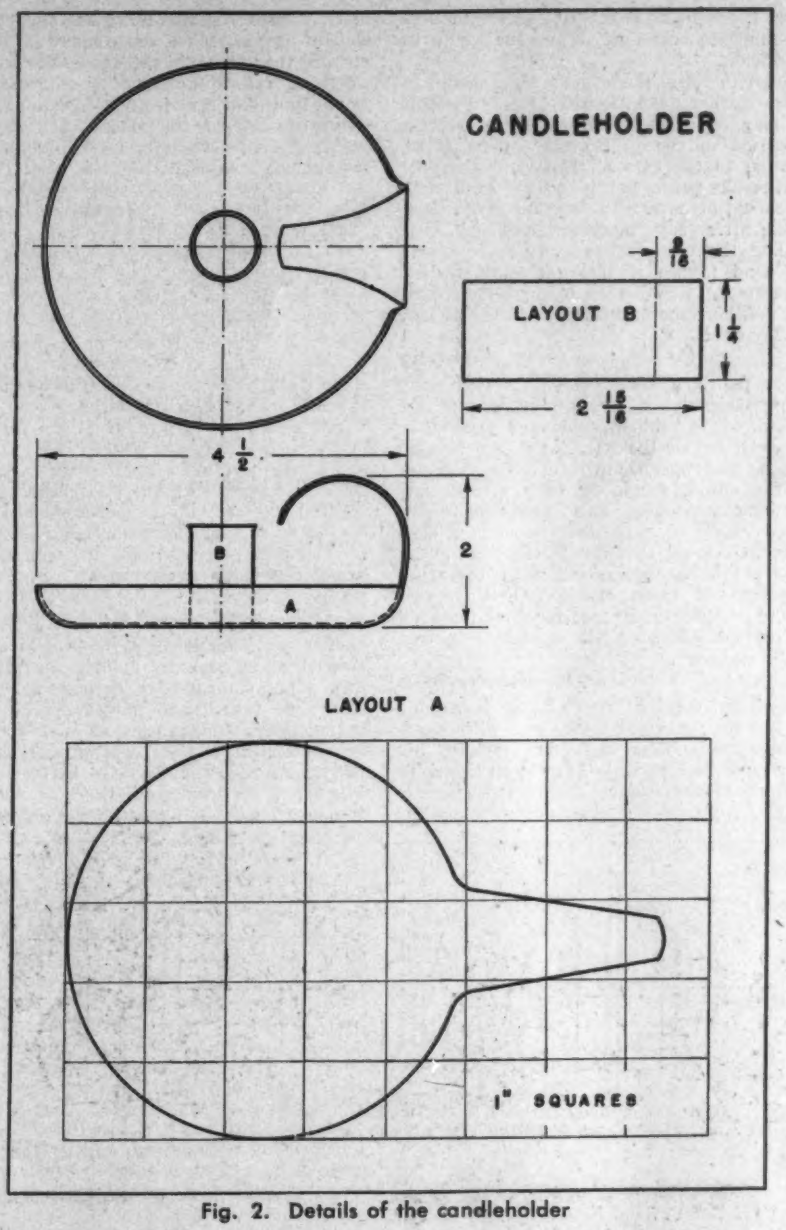


Fig. 2. Details of the candleholder

precaution of handling the project with a cloth should be observed in applying the antique finish.

BILL OF MATERIALS

No. of pieces	*Item*	*Size*
2	Sheet tin	5½ x 8
1	Sheet tin	1½ x 2-15/16
	Solder, flux, steel wool	

Tools:

Alcohol burner, asbestos sheet, copperplating setup, emery cloth, file, flat iron, forming block, heating device, lead or wood block, lead weight, peening hammer, pencil, rule, scriber, soldering copper, and tin snips.

Procedure:

1. Make drawing or layout of candleholder as shown in Figure 2.
2. Cut out 2 pieces of tin stock for main body.
3. Solder one side of each piece.
4. Sweat both pieces together with hot flat iron. Weight the soldered parts together immediately as more is sweated.
5. Lay out or transfer pattern for main body.
6. Cut out body with tin snips.
7. File and dress edges with emery cloth.
8. Form tray or body over a forming block with peening hammer.
9. Form handle as shown in Figures 1 and 2.
10. Form candleholding cylinder, layout B in Figure 2, and solder seam.
11. Place cylinder in place and sweat solder to tray.
12. Rub candleholder with steel wool and prepare for plating.
13. Apply thick coating of copper.
14. Polish project with steel wool. Hold the project with a piece of cloth to prevent touching the metal with the hands.
15. Apply antique finish and high light with steel wool.
16. Apply coat of clear metal lacquer and allow to dry.

COURSE OF STUDY FOR FIRST-YEAR INDUSTRIAL-ARTS MACHINE SHOP

ROBERT L. MOHLE
Hyattsville, Md.

Operations Involved

1. Layout work
2. Measurement
3. Grind chisels, drills, and center punches
4. Cross-file
5. Drawfile
6. Saw with hacksaw
7. Cut threads with taps and dies
8. Remove broken tap
9. Anneal metal
10. Harden steel
11. Temper tools
12. Caseharden
13. Use wrenches
14. Use screw driver
15. Dress emery wheels
16. Clean and oil drill press
17. Adjust belts and speeds of drill press
18. Set up work
19. Do drilling and countersinking
20. Drill cylindrical work
21. Clean and oil lathe
22. Grind and set tool bits
23. Handling chucks and faceplates
24. Do spindle turning
25. Center work in a chuck
26. Do chuck work
27. Drill in lathe
28. Cut taper using compound rest
29. Cut taper using taper attachment
30. File work in lathe
31. Knurl
32. Measure work in lathe
33. Polish in lathe
34. Simple forging

Suggested Projects

1. C Clamp
2. Center punch
3. Nail set
4. Screw driver
5. Ball-peen hammer
6. Cold chisel

Related Information

1. Names of tool bits
2. Types of chucks
3. Types of screw threads
4. Use of cutting oil
5. Types of taps and dies
6. Care of taps and dies
7. Names and uses of hand tools
8. Methods of sizing drills
9. Use of drill gauges
10. Grades of abrasive cloth and paper
11. Kinds of chisels
12. Types of steel and their uses
13. Form, grade, and cut of files
14. Sizes and kinds of saws
15. Blast furnace, open hearth, and crucible processes
16. Kinds of drills
17. Drill terms
18. Speeds and feeds of drills
19. Kinds and speeds of grinding wheels
20. How to read simple blueprints
21. Cutting speeds in lathe work

GENERAL OPERATIONS IN THE WORKING OF PLEXIGLAS

LAUTON EDWARDS
Knoxville, Tenn.

Craftsmen can now make many projects from the new crystal clear Plexiglas. The material can be worked with the average tools

found in a woodwork shop. It is handled the same way as wood in many operations, although it must be machined much slower than wood.

The material comes finished with the exception of the ends and edges. The faces are usually the larger portion of the projects, which can retain their finish if care is taken in working the material. This is done by leaving on the masking paper with which Plexiglas comes from the factory, until it is ready for buffing.

Plexiglas can be bent or twisted to any form by heating. The common joints are easily made as with wood.

Laying Out

The masking paper makes a good surface for laying out. The edges and ends, having been sawed and having a light surface, may be readily marked with a pencil. If a compass is used for marking a curved line, some object should be placed under the point of the compass to keep it from making a dent in the finished surface under the masking paper. Paper, the thickness of drawing paper, is sufficient if care is taken not to put too much pressure on the compass. When the project requires the use of a pattern, the outline of the pattern should be traced on the masking paper. If possible, the masking paper should be left in place during the process of working.

Sawing

The saws found in wood shops are satisfactory for working Plexiglas. They should have very small sets and should be kept sharp. The handsaw found in a woodshop usually has too much set for cutting Plexiglas. Too much set in the saw causes chips on the underside of the Plexiglas, thus requiring more sanding and scraping to get the material back into shape. Therefore, care should be taken to get the proper set on the saw before using it. When using a circle saw Plexiglas does not chip very much if the saw is set more than the thickness of the stock above the table. This gives the saw more downward cut. For the best results, the saw should be small, at least six teeth to the inch. By running the saw at a higher rate of speed, better results will be obtained. It is important that the stock be fed at a slow rate of speed so that the heat will not be sufficient to soften the Plexiglas.

Removing Saw Marks

The saw marks may be removed by sanding, filing, or scraping. If the surface is straight, scraping with the blade of a cabinet scraper gives good and quick results. The blade should be in good condition; if not, it will leave scars that will take as long to sand out as the saw marks. When saw marks appear on a curved surface, a small tooth cabinet file may be used to remove them. The file must be used with very little pressure. For a smoother surface a metal file may be used after the cabinet file.

Sanding

The filing or scraping operation may be omitted if sanding disks, which are easily made for the lathe, are available. For rough sanding a disk about eight inches in diameter should be made with No. ½ sandpaper glued on the face and with abrasive cloth glued on the circumference. Other disks should be made by the same procedure with smaller diameters and with finer sandpaper. A smaller disk enables the workmen to sand a smaller inside curve. For inside curves that are too small for sanding disks, different size cylinders may be made and used on the drill press. These should be made of different grades of sandpaper according to the surface to be smoothed.

Holes in rings, shade pulls, etc., should be bored smaller than desired; then, a rattail file may be cut to a length of four inches and used in the drill press for filing the material to the correct shape and size. For good results before polishing some hand sanding should be done with very fine, worn sandpaper after any machine sanding. After sanding the material, rub the surface with the hand to see if there are any streaks. Regardless of how shallow or small the streaks are, polishing should never be started as long as they exist.

Polishing

For polishing inside curves a cloth may be put around a dowel and fastened in the drill press. A rubbing compound applied on the cloth and on the Plexiglas should be used for the first operation; then a cloth, placed on the dowel, should be used without any polishing substance. This operation merely removes all of the rubbing compound. A waxed cloth on the dowel will then put a good polish on the surface. Since too much pressure will cause excessive heating, care should be taken in all machine operations not to get the Plexiglas hot enough to give a white surface.

Turning Plexiglas

Cylinder turning in Plexiglas is accomplished on the wood lathe, and with woodturning tools. The tools dull rapidly, but they must be kept very sharp at all times. To prevent streaks from appearing in the material, care should be taken not to apply too much pressure on the Plexiglas. The corners should be sawed off or sanded off before putting the piece on the lathe. For cutting to shape, follow the same procedure as for wood. Finish with fine, worn sandpaper, after which use rubbing compound. Then wax and polish. A very soft cloth should be used with the rubbing compound and wax.

Faceplate Turning

Faceplate turning has a few complications, but several operations can be worked out by the use of molds. The molds should be made to suit conditions as shown in Figure 1. There are two types of molds used. Mold No. 1, in Figure 1, is used when working on a disk that has a hole through its center, while mold No. 2 permits work to be done on the face of the Plexiglas disk.

The molds are turned up on the faceplate of the lathe. They are of 1-in. pine lumber. After they have been trued up the faces that come in contact with the Plexiglas should be covered with felt. Both types should be made a snug fit so that they will clamp the Plexiglas sufficiently to prevent it from slipping while it is being worked upon.

Bending and Molding Plexiglas

If a piece of Plexiglas is to be bent or twisted, it is done by holding the material over a hot plate until it becomes limber. It should be turned and moved several times during the heating process so as to keep the heat uniform. Blisters will appear on the Plexiglas if it is kept on the heat too long. Pliers may be used to hold the material to the heat, but too much pressure must not

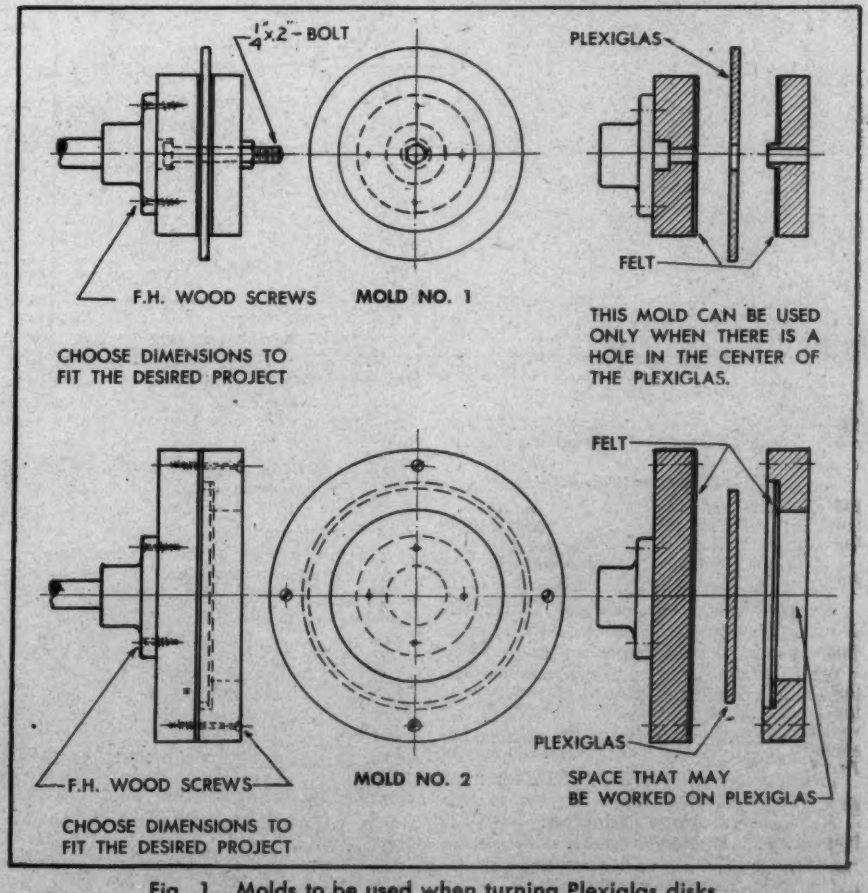

1/4" x 2" - BOLT
PLEXIGLAS
FELT
F.H. WOOD SCREWS
MOLD NO. 1
THIS MOLD CAN BE USED ONLY WHEN THERE IS A HOLE IN THE CENTER OF THE PLEXIGLAS.
CHOOSE DIMENSIONS TO FIT THE DESIRED PROJECT
FELT
PLEXIGLAS
F.H. WOOD SCREWS
MOLD NO. 2
SPACE THAT MAY BE WORKED ON PLEXIGLAS
CHOOSE DIMENSIONS TO FIT THE DESIRED PROJECT

Fig. 1. Molds to be used when turning Plexiglas disks

be applied for it will leave dents in the material. In twisting a long piece hold it with the hand and twist while heating; and in making a piece round or oval, as for a bracelet, for instance, place it around an object of the desired size after heating. The object used for a mold must be smooth and the Plexiglas may be held in place with a cloth. The Plexiglas will cool enough in two or three minutes to be taken from the mold. If a dish or bowl is the object, a mold should be made; and after heating, place the Plexiglas over the mold. To prevent dents or scars, care should be taken not to use too much pressure in clamping the material over the mold. A watch crystal can be made by heating the Plexiglas and shaping it in the face of the watch by using a soft cloth with the hand.

In making a towel rack, the ends of which are to be bent round for fastening to the wall, heat the ends over a hot plate and bend them around an object with the desired curve. If a very large piece is to be heated, the best results are obtained by heating in an oven at a temperature of 300 deg.

Dyeing

Select the proper color and the desired brand of dye and follow the directions on the container. To glue Plexiglas, use a good invisible glue, and follow the directions on the container.

Plan of Procedure for a Table Lamp

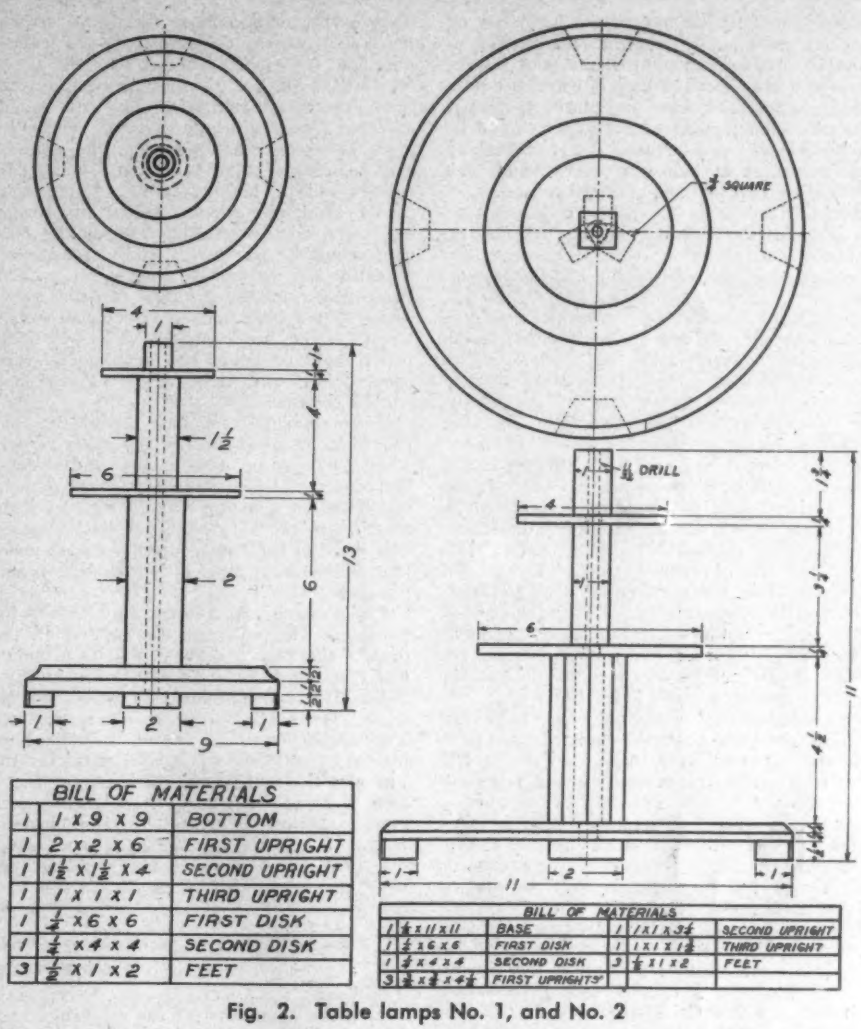
The Base

Lay out the desired dimensions on the masking paper with a compass; then cut out the pattern with a band saw or a jig saw. Due to chipping, care should be taken to give more waste space on the outside of the line than on wood. The coarser the saw, the larger the chips will be. If a band saw is used, saw farther away from the line than when using a jig saw or a coping saw. When thin Plexiglas is used 3/32 in., or thinner, a jig saw should be used because this thickness of material is likely to form cracks at least one half inch into the material, if sawed on a band saw.

Sand the edge to the marked line on a disk sander. It does not have to be a true circle after sanding is completed. Bore a hole in the center ½ in. in diameter which will aid in assemblying on the lathe for any designs or shapes desired. The hole should be bored with a twist drill in a drill press because an auger bit has a tendency to crack the Plexiglas.

Assembling Base on Lathe

Use mold No. 1 in Figure 1 for turning the base on the lathe. This is a form of faceplate turning, and the top of the mold should be tightened enough to make the Plexiglas turn with the base of the mold. The turning tool should be very sharp, and it is best to use a skew chisel, because Plexiglas finishes better after a scraping cut such as is given by the skew. The round nose gouge is the next important tool in turning. Care should be taken not to exert too much pressure in order to prevent heating of the material, because heat will give a white gummy surface on the Plexiglas. A shield should be used to protect the eyes while face turning. After the desired design has been cut No. O sandpaper should be used. To prevent any kind of scratches it is better to warm the sandpaper before sanding with it. After using the No. O sandpaper, use No. 2/0 to remove any scratches left, and for the last sanding before polishing use No. 4/0 sandpaper. This sanding must not be carelessly hurried over.



BILL OF MATERIALS		
1	1 x 9 x 9	BOTTOM
1	2 x 2 x 6	FIRST UPRIGHT
1	1½ x 1½ x 4	SECOND UPRIGHT
1	1 x 1 x 1	THIRD UPRIGHT
1	¼ x 6 x 6	FIRST DISK
1	¼ x 4 x 4	SECOND DISK
3	½ x 1 x 2	FEET

BILL OF MATERIALS					
1	¼ x 11 x 11	BASE	1	1 x 1 x 3½	SECOND UPRIGHT
1	¼ x 6 x 6	FIRST DISK	1	1 x 1 x 1½	THIRD UPRIGHT
1	¼ x 4 x 4	SECOND DISK	3	½ x 1 x 2	FEET
3	¼ x ¼ x 4½	FIRST UPRIGHTS			

Fig. 2. Table lamps No. 1, and No. 2

Polishing

The duco rubbing compound is good to obtain a fine polish. Place some of it on a cloth and hold it against the Plexiglas while it is still on the lathe. Again, too much pressure will cause excessive heating of the Plexiglas. When the material has a clean, clear appearance, a wax is used to shine it. The duco wax is good. Put the wax on a soft cloth and shine by holding it with little pressure to the Plexiglas. The speed of the lathe is not very important in turning, sanding, or polishing Plexiglas if the proper amount of pressure is used at all times. Remove the piece from the mold when it is properly polished.

Cylinder Turning

For a cylinder that is 2 in. in diameter and 9 in. in length, a piece of at least 2⅛ by 2⅛ by 10 in. should be used. The center may be found by drawing diagonal lines on each end. The end used for the live center should be sawed on the line at least 3/16 in. in depth and a hole should be bored just smaller than the dead center and 3/16 in. deep. Before placing the piece between the centers of the lathe, the corners of the square should be sawed or sanded off. The corners should be marked before sanding to be sure that one corner is not sanded more than the other, thereby causing the stock to run out of true.

When placing the piece between centers, apply just enough pressure to get the prongs of the live center firmly into the grooves. If too much pressure is applied, cracks will form in the ends. Before turning, the tailstock should be turned about ⅛ of a turn back. This will loosen the dead center and prevent heating. Then apply oil on the dead center and turn the stock around by the hand to check the guard and its distance from the stock to be turned. In turning, the gouge should be used first, but only until the corners have been rounded off. Then the skew chisel should be used until the proper dimensions have been reached. The dimensions should be about 1/32 in. larger than the desired dimensions, which may be checked by the use of outside calipers.

For sanding and polishing, the same procedure should be followed as for the base. Check the drawing and bill of materials for dimensions.

Turning Center Disk and Top Disk

The masking paper should be on the Plexiglas for this process. If the material does not have masking paper on it, a paper may be taken from another piece and used. The paper will enable the workman to mark the pattern with a compass. The same procedure should be followed in marking and sawing it as was used for the base. Use a No. 1 mold for cutting these disks.

The feet are made by making a pattern which is then traced on the masking paper of the Plexiglas to be used. All four parts should be marked off before sawing is started.

They should be cut out by the band saw or jig saw and clamped together for sanding in the disk sander. This saves time and assures uniform size. Hand sanding is necessary after disk sanding. The same procedures in the use of the different sizes of sandpaper should be followed as in the base. Put the rubbing compound on a cloth and rub by hand. The wax is also applied and rubbed by hand.

Boring Holes

The holes are bored in the disk before turning and should be the same size as the bolt to be used in the mold. The bolt should be just a little smaller than the nipple that fits a light socket. This enables the nipple to stay firmly in the top of the cylinder. If the desired twist drill is not on hand a smaller drill can be used and the diameter of the hole increased to the desired size by the use of a rattail file about 4 in. in length. The tang end of the file will have to be cut off before it can be used in a drill press. Before boring a hole, it is very important that the cylinder is perpendicular to the drill press table. A piece of wood should be placed under the cylinder of Plexiglas to prevent chipping as the drill goes through it. One advantage that Plexiglas has over wood in the boring of holes is that the workman can see where the end of the drill is, and in what direction it is going at all times. In order to prevent heating, the hole should not be bored rapidly. After the hole is bored a snow white color is left on the circumference of the hole. If a clear finish is desired it may be obtained by making a small sanding drum to be used in the drill press. This drum is made by gluing 4/0 sandpaper on a 3/16-in. drill. By the use of the drum the streaks or scratches may be taken out. A cloth with a rubbing compound applied should be put over a 3/16-in. dowel and placed in the drill press and used until the sanding streaks are out. Then a soft cloth on the same size dowel, with wax applied, is used in the drill press to polish.

If a clear finish is desired on the circumference of the hole this should be known before the hole is bored, because the hole must be drilled 1/16 in. smaller to allow for the sanding.

Assembling

A good invisible cement should be used to fasten the parts of the lamp together. Be sure to follow the directions on the cement container.

Plan of Procedure for Making the Paperweight

The Base

The dimensions, ½ by 5¼ by 3¼ in., should be marked off on the masking paper and sawed out with the use of a table saw. See Figure 3. The saw should be at least 1 in. higher than the top of the Plexiglas in order to give the teeth a more downward stroke which will prevent chipping from the underside. The fence should be set so as to allow at least ⅛ in. for sanding because of the chips. The saw should have very little set in it. The Plexiglas should be fed slowly to prevent heating. After sawing, the corners may be marked off to ½-in. dimensions. The corners can be best taken off by the disk sander after the streaks caused by sawing have been eliminated. The first sanding disk used should be faced with No. ½ sandpaper. After the saw marks have been taken out and the corners sanded off, disks with 2/0 sandpaper should be used. To remove all minor streaks, some hand sanding with 4/0 sandpaper must be done. If the paper is worn some before using the results accomplished will be better.

Duco rubbing compound should be used following the sanding. The operation is performed by putting it on a cloth and rubbing the edge by hand or by putting the rubbing compound on a buffing wheel using very little pressure to prevent heating of the Plexiglas. The speed of the buffing wheel does not make any difference as long as the pressure is not too great.

The masking paper should be removed for polishing. The wax may be applied on the project and then it may be held to a buffing wheel or rubbed by hand with a soft cloth.

To make the upright the correct dimensions, 2¼ by 2¼ by 2¼ in., are marked off. The upright may be sawed to dimensions by the use of the table saw. The thicker the Plexiglas the more danger of heating; therefore it should be sawed very slowly with margin allowed for chips. The ¼-in. chamber may be marked off by the use of pencil gauging. The corners at the bottom are done likewise, and are sanded off as the corners were on the base.

Plan of Procedure for Making a Twin Picture Frame

The Base

1. Make a pattern for the case and check the drawing for size and shape. See Figure 4. Drawing paper is used for making the pattern, but any good stiff paper is good.
2. Cut out the pattern.
3. Trace the pattern on the masking paper of the Plexiglas to be used.
4. Saw out the pattern with a band saw, jig saw, or coping saw. The jig saw is probably the best. The saw should have small teeth with very little set. Since so much sanding is required to get the saw marks and chips out, it is best to saw about ⅛ in. on the outside of the line.
5. The craftsman should have sanding disks made of different sizes and grades of sandpaper to be used on the lathe or other power machines. The grit of the sandpaper should range from ½ to 4/0. The diameters of the sanding disks should range from 3 to 8 in. Abrasive cloth may be glued to the edge of the disk, with sandpaper glued to the surface of the disk. The sanding disks will enable the craftsman to sand the Plexiglas smoothly and fast. The disks with the No. ½ sandpaper should be used first. If the craftsman moves the Plexiglas around to sand it at different places, and does not apply too much pressure, he will not heat the material unduly. After using the sanding disk with 4/0 sandpaper the same process must be followed by hand with the same grade of sandpaper.
6. Rubbing compound may be applied on a buffing wheel, but the best results are obtained when rubbing by hand. The compound cleans the Plexiglas so that any streaks or scratches may be seen. If any streaks appear, No. 4/0 sandpaper must be used by hand until they disappear.
7. The masking paper should then be removed, and wax applied by use of the buffing wheel. The speed of the wheel is immaterial, but care must be taken not to put too much pressure on the Plexiglas.

Upright

The same procedure should be followed for marking off, sawing, and sanding as in the base. Check the working drawing for all dimensions. Check carefully for depth and angles before setting the table saw for the groove. Rubbing compound and wax are used in the same manner as on the base.

Picture Clamps

The picture clamps that go on the top for holding the front, picture, and back together

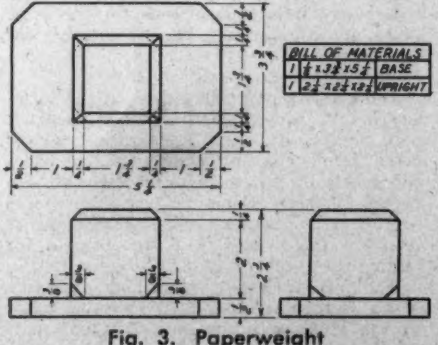


Fig. 3. Paperweight

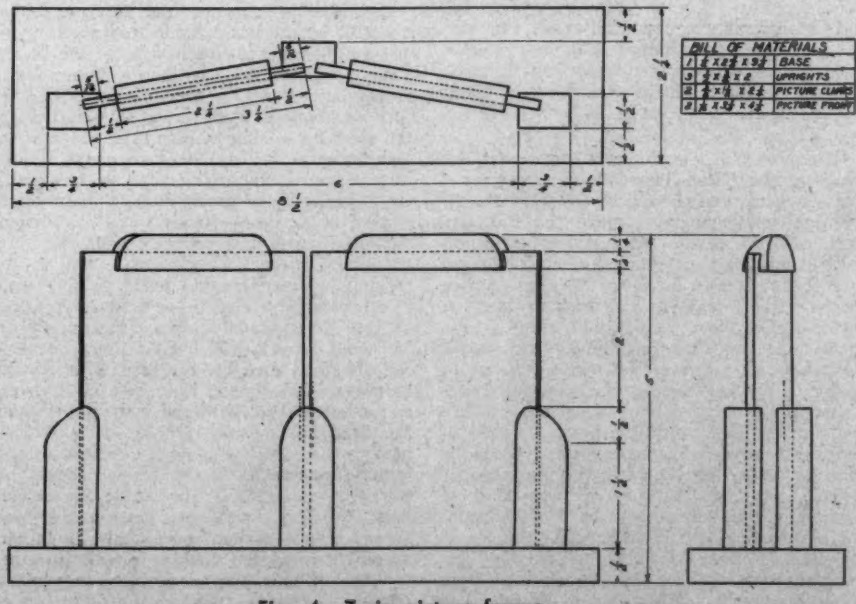
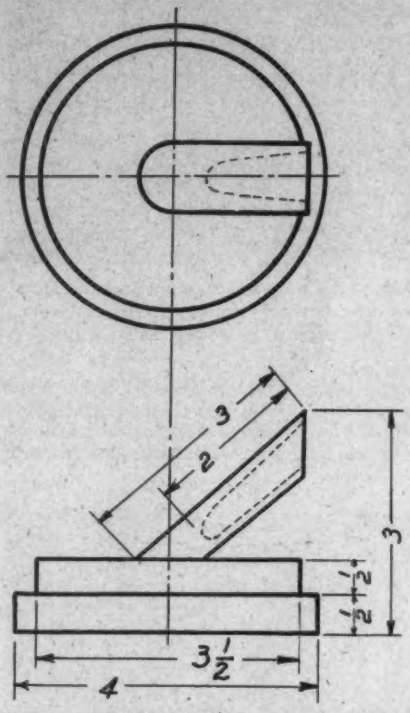
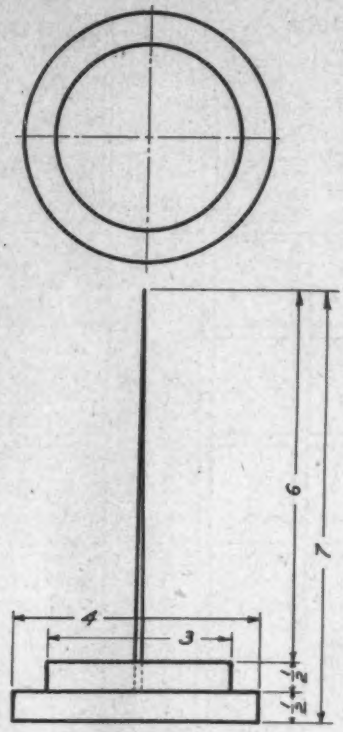


Fig. 4. Twin picture frame



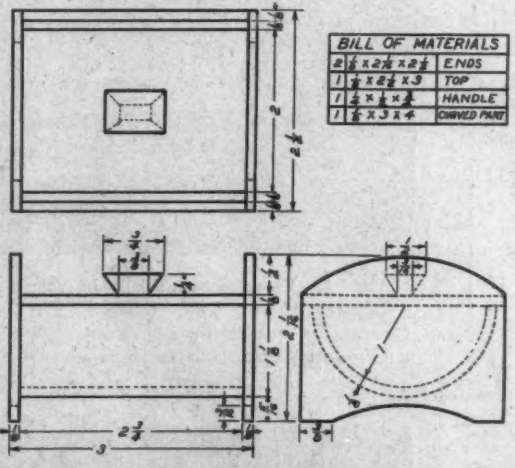
BILL OF MATERIALS		
1	1/2 x 4 x 4	BOTTOM DISK
1	1/2 x 3 1/2 x 3 1/2	UPPER DISK
1	3/4 x 3/4 x 3	PEN HOLDER

Fig. 5. Pen stand



BILL OF MATERIALS		
1	1/2 x 4 x 4	BOTTOM
1	1/2 x 3 x 3	TOP
1	5/32 x 6 1/2	PIN

Fig. 6. Bill file



BILL OF MATERIALS		
2	1/4 x 2 1/8 x 2 1/2	ENDS
1	1/4 x 2 1/2 x 3	TOP
1	1/2 x 1/2 x 2 1/2	HANDLE
1	1/4 x 3 x 4	CURVED PART

Fig. 7. Bobby pin tray

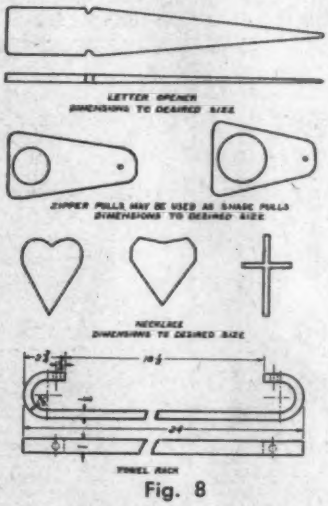


Fig. 8

may be made with the same operation as the upright after checking the bill of material and drawings for dimensions.

Assembling

The upright is glued to the base with any good invisible glue after checking the drawing for spacing. The shield that is placed before the picture should be made after the uprights are firmly glued on. They should be made to fit the upright by following the same procedure for marking, sawing, sanding, rubbing, and polishing as was used for making the base.

ELECTRIC BASKETBALL SCOREBOARD

WM. COSTELLANO

High School

Lyndhurst, N. J.

This practical and inexpensive all electric basketball scoreboard was designed and constructed by the Blue Chapter of the Hi Y of Lyndhurst High School.

Construction Details

A rectangular frame, 59 by 30 by 7½ in., was built of 13/16-in. pine. Within this *frame* 44 boxes 4 by 5 in. are placed. See Figure 1. After the boxes are nailed and screwed in place the scoreboard frame is placed face downward on a piece of ⅜-in. plywood 25 by 30 in. Diagonal lines are drawn across each of the boxes and the centers located. The porcelain sockets are then bolted to the ¼ by 26 by 30-in. plywood. See Figure 2.

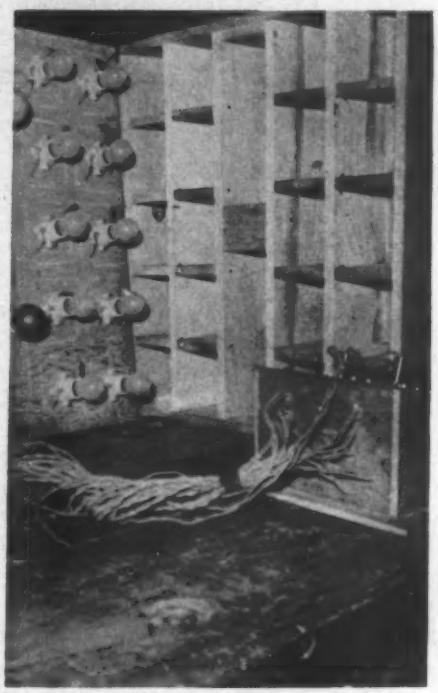


Fig. 2. Bulbs about to be housed in compartments

Place this unit at the rear of the board, and fasten it in place with screws. Then every bulb will be housed in its respective compartment. Two of these sections are required. It is necessary to have two sets of numbers ranging from 1 through 0 for each team. In this way any score from 1 through 99 can be readily recorded. The column of numbers on the left (facing board) is the tens column; the column on the right is the units column. Let's assume the score is 27 for Lyndhurst; then the 2 in the tens column and the 7 in the units column will be lighted. See Figure 3. Separating the two columns is the name of the school. This serves two purposes:

1. Separation of the tens and units.
2. The school name is lighted with amber bulbs and enhances the appearance of the unit.

The *false front* circle top adds height to the unit and harmoniously balances the proportion of height and width. The Blue Hi Y used this top area to place the Lyndhurst High School sporting insignia in the center. See Figure 3. The insignia conceals the two bolts which are fastened to the strap iron support. The top was cut from ⅜-in. plywood and is fastened to a 2 by 3 by 57-in. batten with 12 No. 10 by 1½-in. screws. After the sockets are *housed*, a piece of frosted glass 3⅞ by 4⅞ in. is placed in the box approximately 1 in. from the front. The glass is

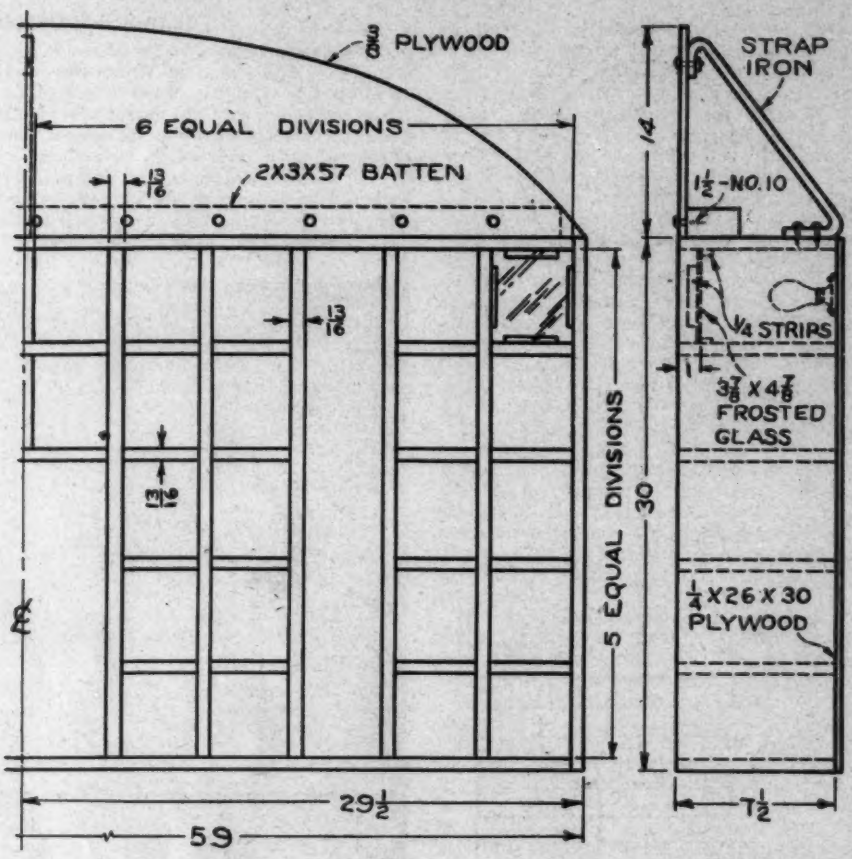


Fig. 1. Detail of framework and control box of scoreboard

held in place with ¼-in. strips. This glass diffuses the light and prevents glare. The final step of construction is the jigsawing of the numbers, 3½ in. high, and ⅜-in. letters out of the plywood front. The section is screwed in position and is now ready to be painted or shellacked. Clear lacquer may also be used.

See Figure 1 for details of the control box, and Figure 5 for diagram of the wiring.

Electrical Hookup. The board is wired in a simple, yet practical way. A length of No. 14 wire is hooked to the *hot* side of each porcelain socket in parallel fashion. If soldering lugs are used this task will be simplified. The *ground* side of the porcelain socket is wired with No. 16 flexible wire, and is brought to the telephone-like control box, where it is soldered to a radio jack. See Figures 1 and 5.

There is no danger of ever overloading the wires. The size wire used will safely carry 20 amps of current; yet, when the maximum number of bulbs are lighted (9), the amperage passing through the wires is only 1½ amps. It can readily be seen that an overload is impossible. The Hi-Y boys further "protected" their board by placing a fuse block with a 5-amp fuse, across the "hot" side of the "hookup."

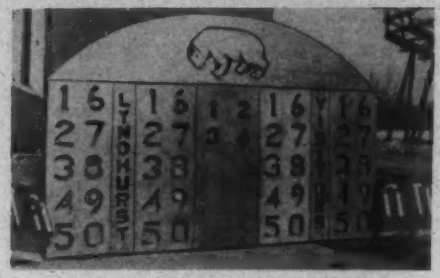


Fig. 3. Completed scoreboard. Two hundred man hours of work were necessary to reach this stage

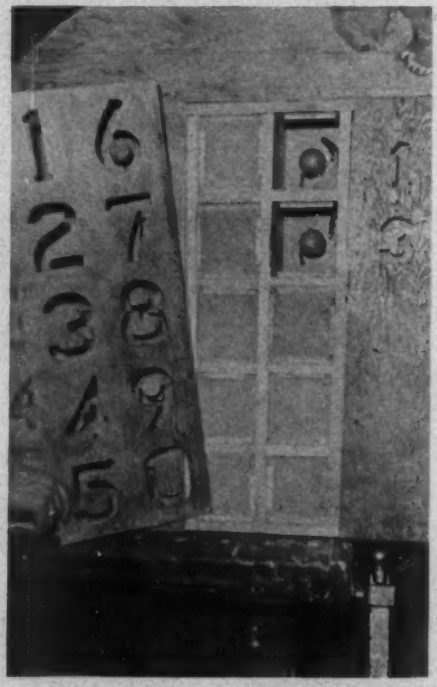


Fig. 4. View shows bulb in compartment; also the frosted glass and the numerals cut from ⅜-in. plywood about to be screwed in position

Fig. 6. Hi-Y boys at work. View shows framework bulbs and control box

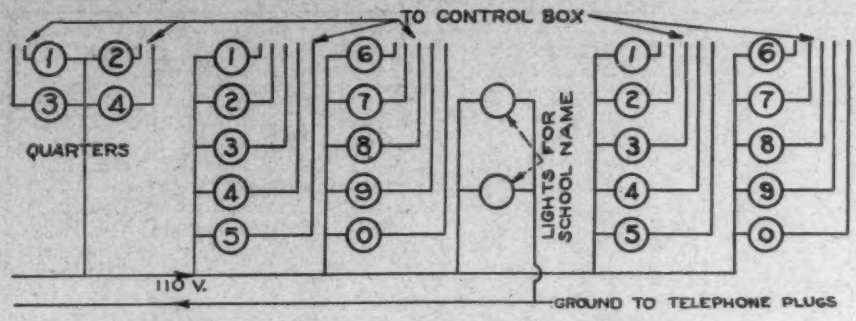


Fig. 5. Wiring diagram of the scoreboard

Of course, the addition of a fuse block is redundant; yet it is worth while, for it tends to make "shop" boys safety minded, and is from an educational view an added technique.

BILL OF MATERIAL

No. of pcs.	*Name*	*Size*
48	Bulbs	15-watt
48	Porcelain sockets	
	Plywood	32 sq. ft. — 3/8 in.
48	Frosted glass	3 3/8 x 4 3/8 in.
2	Frosted glass	3 3/8 x 28 1/4 in.
44	Jacks	
4	Telephone plugs	
75 ft.	Wire	No. 14
1	Fuse block	
400 ft.	Flexible wire	No. 16
30 lineal ft.	Pine	13/16 by 8 in.
1	Pine	2 x 3 x 57 in.

THREE-STEP TIE RACK

ISADORE M. FENN
Chicago Vocational School
Chicago, Ill.

Students will not have to be coaxed into making this three-step tie rack. Most of them will want permission to make extra tie racks to be used as gifts for dads, brothers, relatives, and friends. This attractive and practical project can be made in a short space of time with the use of a few common tools and a very small amount of material.

Steps in Construction:

1. Study blueprint
2. Obtain required material
3. True up both ends of all pieces
4. Make layout on ends
5. Cut out both ends and shape them according to the drawing
6. True up the three bars to the correct dimensions
7. Cut six dowels to the required size
8. Bore holes in bars and ends
9. Sandpaper all the parts
10. Assemble with glue
11. Finish as desired
12. Take tie rack home, attach in appropriate place, and fill with ties.

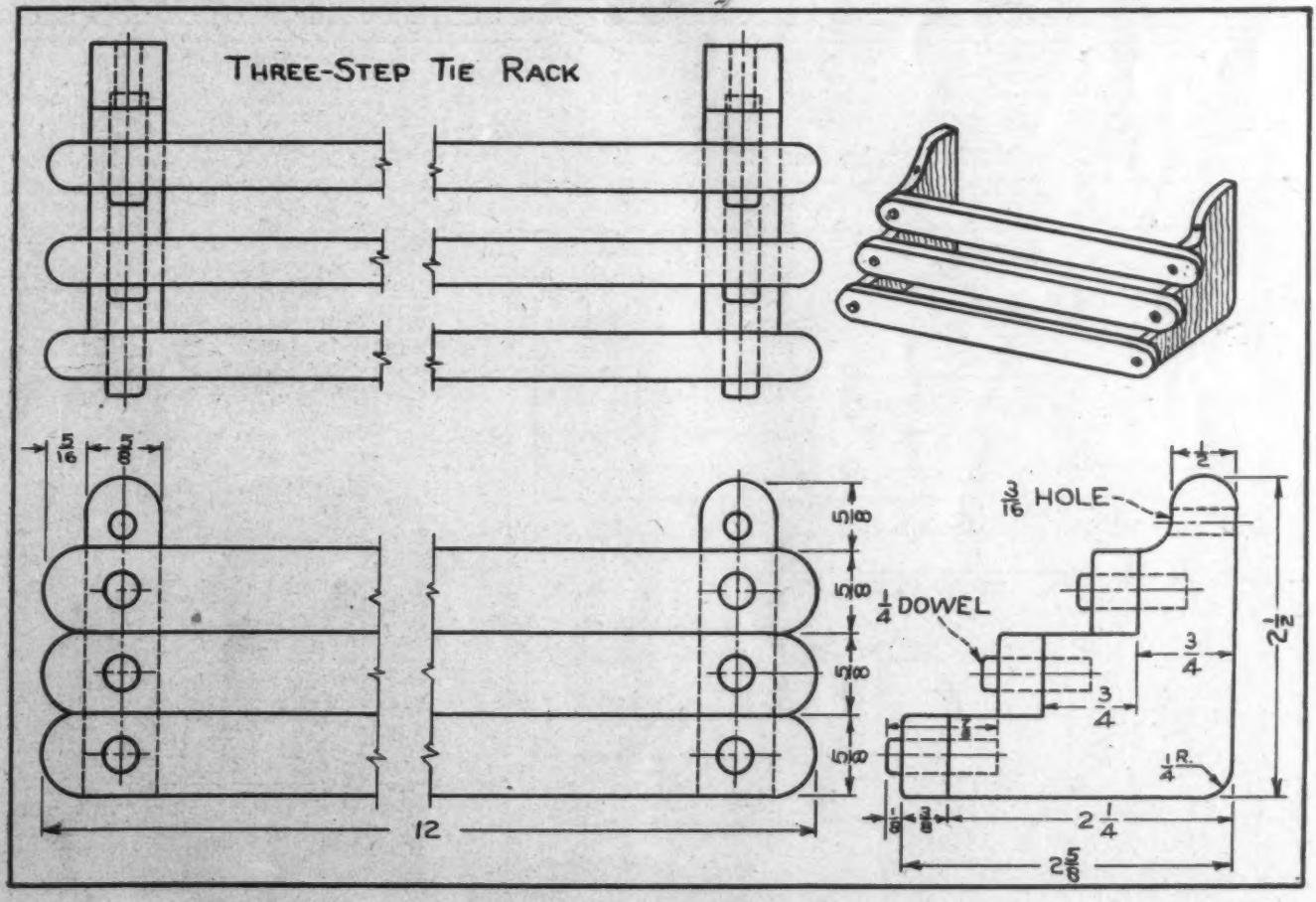
Experiences: Blueprint reading, planning, obtaining material, planing, squaring, layout, measuring, hand sawing, sawing irregular curves, chiseling, boring, sanding, assembling, gluing, finishing.

Some instructors take this opportunity to give their students experience in the use of the circular saw. The students cut up all the bars during a shop period, and each student is allowed to rip his own three bars.

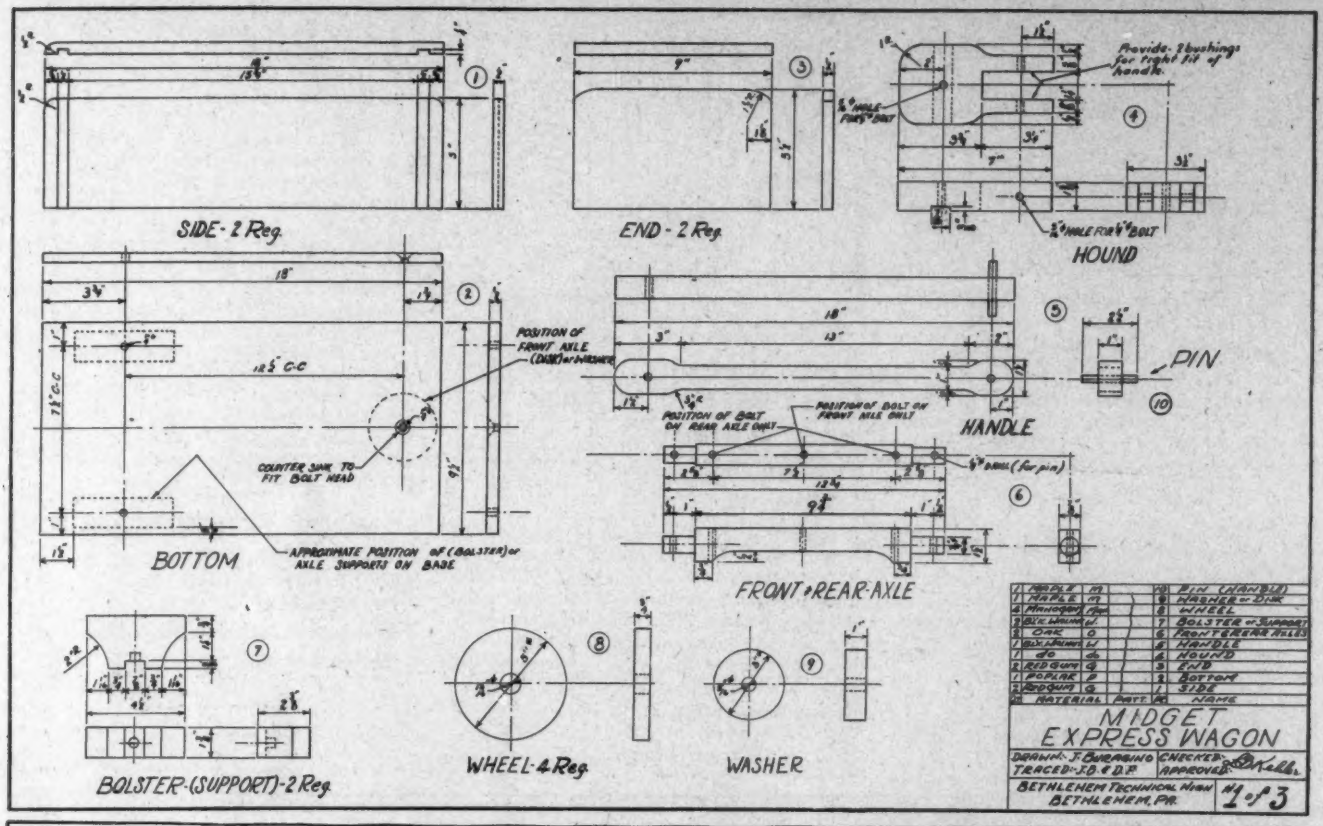
MIDGET EXPRESS WAGON

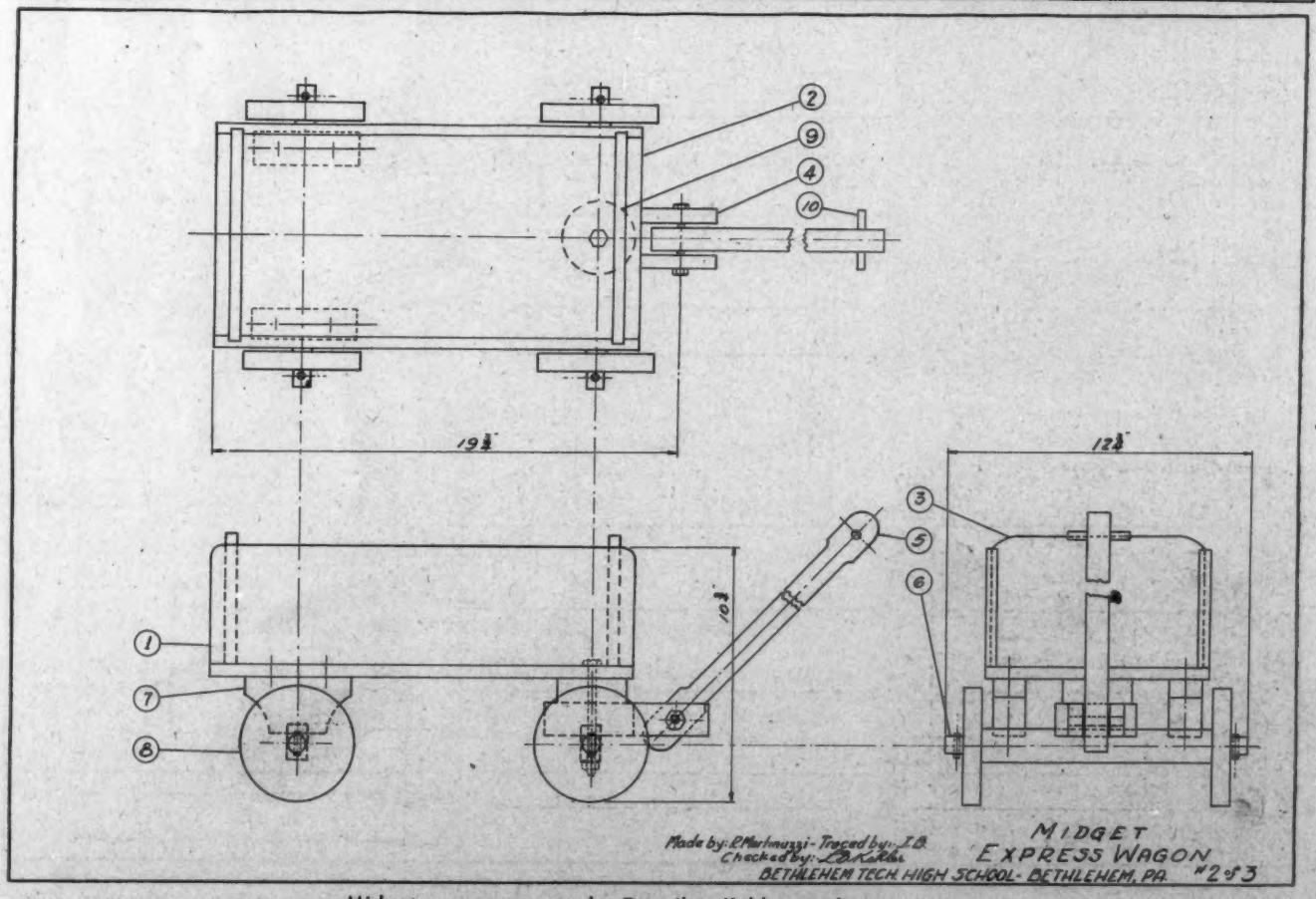
DONALD L. DETWILER,
LLOYD B. KEHLER, and
P. W. MEMMERT
Bethlehem Technical High School
Bethlehem, Pa.

The war has taught us to utilize wood for the construction of many things which were formerly made of metals. Formerly many of the toys available were made of light-

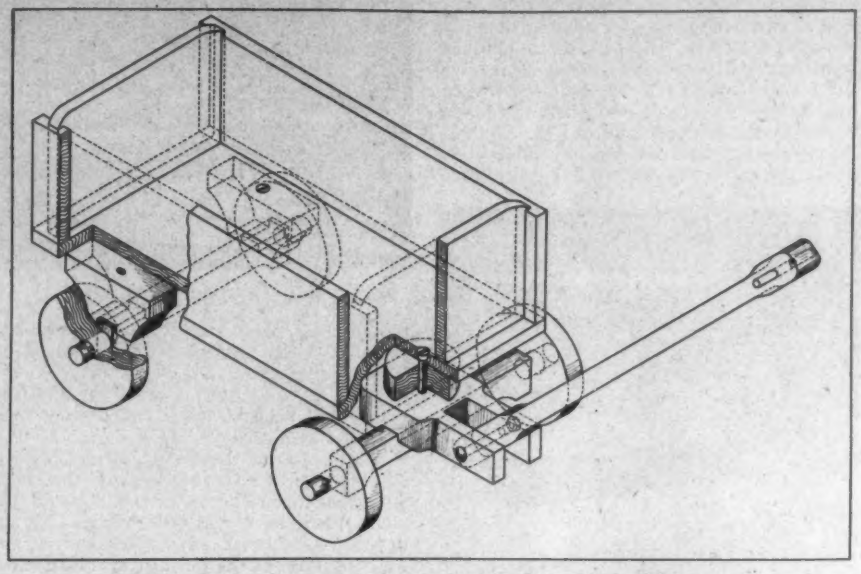


Three-step tie rack by Isadore M. Fenn





Midget express wagon by Detwiler, Kehler, and Memmert



View showing bolsters, rear axle, and the like

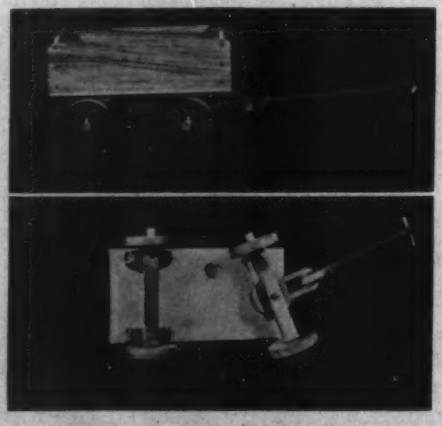
weight, cheap metals. These toys were very crudely constructed, and they were unable to withstand the punishment to which the average child subjected them. The child thus learned to become careless through the use of these toys.

The midget express wagon described herewith is sturdy and well built, and any small child will derive much pleasure from its many uses. Heavy loads of more than 200 lb. had no effect upon the wagon and in no way weakened its sturdy construction. In the school shop or the home workshop, its construction affords excellent practice on both the bench and the machine. Due to the small size of this wagon, odds and ends of the materials which would otherwise go to waste may be used in its construction. Any available woods are suitable, but the wheels and axles should be turned out of hardwood, such as maple, gum, oak, mahogany, or the like. There is only about three board feet of lumber required on the whole project.

By examining the details in the illustrations, it will be found that all the parts were so designed that they would add strength as well as simplicity in the construction of the project. The sides and ends are gained and nailed to add strength to the box. The bolsters and rear axle are gained and then screwed to the box. On the front axle the hound and axle are gained and the wood washer or disk added to permit easy wear, turning, etc. Bolts with lock washers are used on the front axle and wagon handle.

The finish on this project may vary according to the taste of the individual who is making it. The parts may be dipped in different colored wood dyes to present an assembled wagon of different colors, or the parts may be hand painted and hand striped. The latter type of finish would, of course, present a better appearance.

The illustrations showing the working details, assembly, perspective, and the accompanying half tones are self explanatory.



Side and bottom view of midget express wagon

TOOLMAKERS' BUTTONS

ROBERT L. MOHLE

Hyattsville, Md.

Toolmaker's buttons are used for locating holes in layout work with extreme accuracy. To use them, lay off the holes in the usual way and then drill and tap each hole for a 6-32 screw. The toolmaker's buttons are then fastened on the work with the screws, and due to the oversize holes in the buttons, they can be shifted on the screws until they are located exactly by use of micrometers. By this method the holes can be located from the side of the work or from another hole or another button.

To make the buttons use tool steel or drill rod. Drill the ¼-in. hole and turn the diameter and cut to length, leaving .010 or .015 in. on both diameter and length for grinding after hardening. When grinding, make sure that the ends are square with the center line.

One button is longer than the others so that when two are used close together it is possible to use an indicator on them. The base is made of cold rolled steel because it is only used to keep the buttons and screws together and protected when not in use.

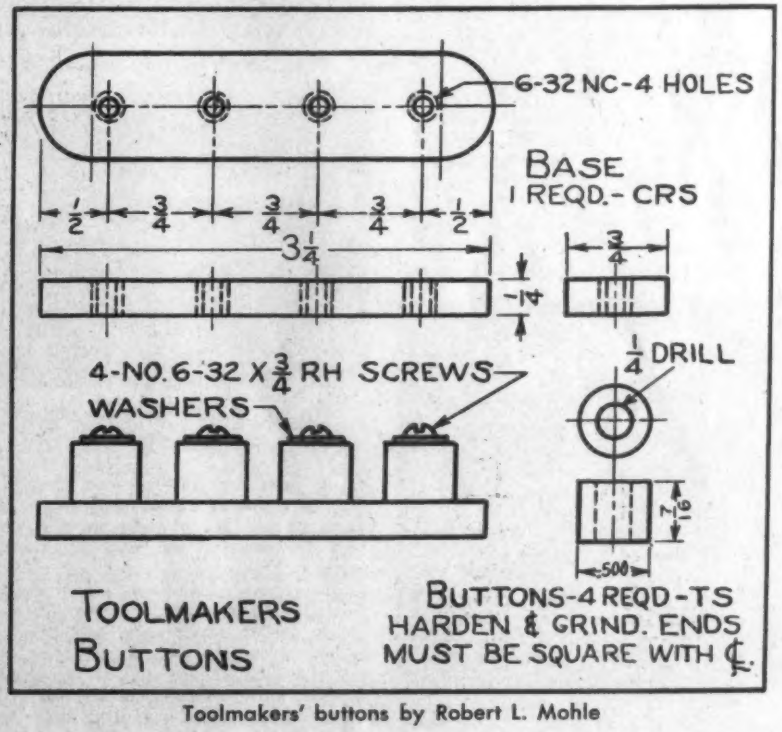
PHOTOENGRAVING IN THE SCHOOL SHOP

EDWARD T. DE VOE

Thaddeus Stevens Junior High School

Williamsport, Pa.

Schools interested in expanding their graphic-arts departments after the war should consider the possibility of installing a photoengraving laboratory in their school print shops. The photoengraving process has been simplified in the past few years until it can be safely handled in the school shop. It will prove a valuable asset, especially if your



Toolmakers' buttons by Robert L. Mohle

Fig. 1. Copying with the camera

school publications use costly commercial engravings.

A project in photoengraving that started as an experiment in the print shop of the Thaddeus Stevens Junior High School, Williamsport, Pa., is now a valuable part of our school plant. All line engravings used in our school magazine, *The Stevens*, are a product of this undertaking. All of the photoengraving equipment, camera excepted, was manufactured in our school shops and is efficient to the degree that we can produce line engravings comparable to the commercial product.

This article will not attempt to explain the photoengraving process in its entirety. It is rather a description of our efforts to produce acceptable engravings for our school needs. The results, we feel, have justified the means. In addition we have acquainted many boys with this interesting trade and have added a valuable graphic-arts process to our curriculum.

Lacking trade experience, we started from scratch. Books on the subject are meager, and those available are too technical for the layman to interpret successfully. It was evident, after considerable study, that we must first master the photographic end of the business.

A 5 by 7-in. view camera of ancient vintage was secured. With high contrast film supplied by the nationally known manufacturers, we were soon turning out suitable copy negatives. The camera, equipped with a fine anastigmat lens, is shown in Figure 1. Two No. 2 photofloods provide the necessary illumination and an exposure of 20 seconds at f16 is ample for most types of reproduction copy. The film is developed in high contrast developer to provide a black and white negative of sufficient contrast. Reproduction drawings are made in our school art department.

The next step in the process is the preparation of the zinc to receive the printed image. Scrap zinc, pieces too small for commercial use, are obtained from a local commercial engraving plant and cut into sizes not exceeding 6 by 8 in. These plates are polished with powdered pumice and water to remove all surface oxidation. The plate is then coated with a bichromated shellac solution known to the trade as cold top enamel. The coated plate is then whirled face down over an electric stove to provide a uniform coating

Fig. 2. The whirler

of the sensitizer. The machine shown in Figure 2 is known as a *whirler*. When the plate is *warm* to the back of the hand it is removed from the machine and is ready to have the image printed onto the metal.

The copy negative is placed on the glass of the printing frame in a reversed position, glossy side up, and the sensitized zinc plate placed in contact with the negative. Several negatives may be printed at the same time if the plate is of sufficient size to accommodate them. Pressure is applied to the back of

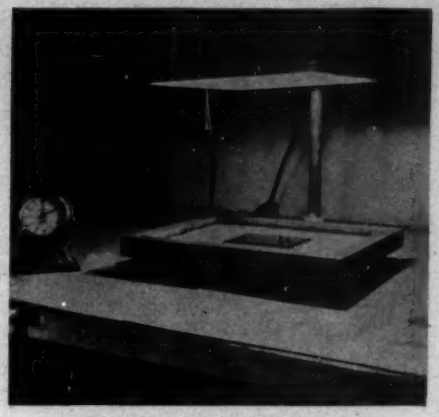


Fig. 3. Printing on the metal

Fig. 4. The etcher

Fig. 5. Burning in the dragon's blood

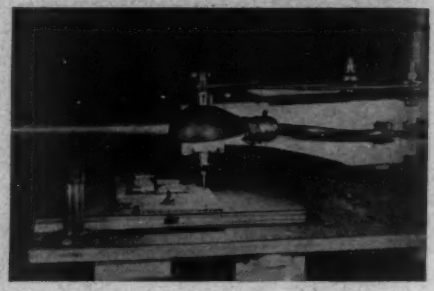


Fig. 6. A radial type router

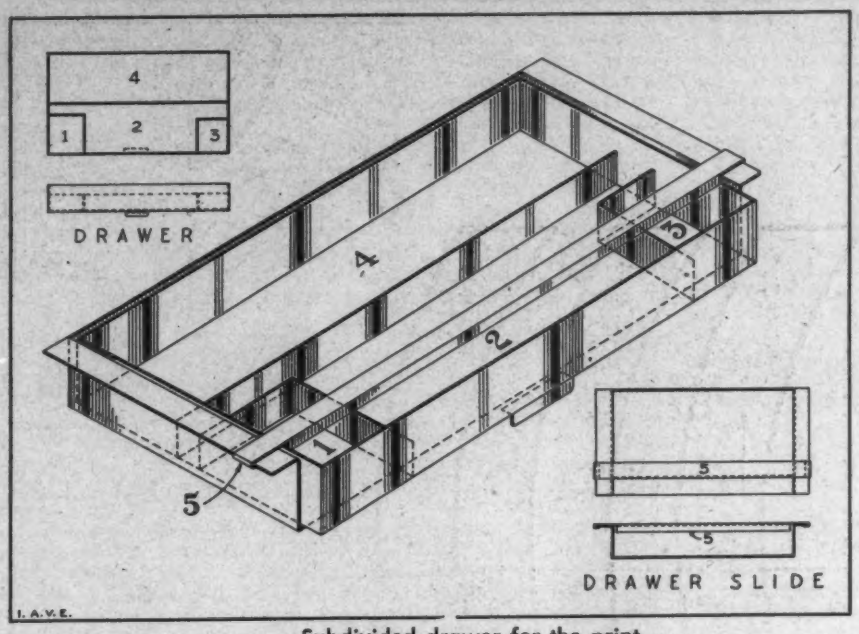
the printing plate and the sensitized plate exposed to the light of a No. 4 photoflood lamp for approximately eight minutes, depending on the thickness of the enamel and the type of negative used. The printing lamp is shown in Figure 3.

After exposure the sensitized zinc plate is developed in methylated alcohol containing an aniline dye. The unexposed areas of the plate which have not been affected by the printing light break away after one or two minutes' time in the developer, and development is completed by washing the plate in running water. Stubborn areas may be swabbed lightly with cotton to clear them. The printed plate is dried gently over heat. Large bare areas are then painted out with lacquer or asphalt varnish to avoid etching areas which may easily be removed by the router in the finishing operation.

The plate, or flat, as it is called, is then ready for the etching operation. This is not a simple process and it requires much skill and practice before good results can be secured. The etcher illustrated in Figure 4 is made entirely of aluminum which is unaffected by the nitric acid etching solution. A 10 per cent nitric acid and water solution is satisfactory as a mordant. The acid is sprayed against the zinc plate by a paddle wheel driven by a fractional horsepower motor. The first etch or *bite* is very brief, from 30 seconds to 1 minute, depending on the type of lines being etched. Fine lines require great care or they will be etched away during the first bite. A line or dot etched away cannot be restored.

When sufficient depth is obtained, or when the plate has been etched as deep as it can stand without destroying the finest lines, the lines must be protected against the lateral action of the acid by banking a resinous powder called *dragon's blood* against the sides of the lines. The plate must be brushed in four directions, one direction at a time, and the powder banked against the lines burned in over a gas plate. The back of the plate is cooled between each burn-in on a burlap roller suspended in a trough of cold water. After powdering the plate in four directions it is ready for the second bite. Four or five bites are required to provide the necessary printing depth. Figure 5 shows the plate being *burned in* after the third bite. The powder is fused against the etched lines and serves as a resist, strengthening the lines as the etching progresses.

The etching completed, large spaces of bare metal between the lines must be removed by a router to avoid offset on the printed sheet of paper. The machine illustrated in Figure 6 is a copy of the radial type of router used in the photoengraving industry. It not only removes unwanted metal from the plate but may be used to cut individual engravings out of the *flat*. A jig saw equipped with



Subdivided drawer for the print

metal-cutting blades would perform the latter operation if a router is unobtainable. It is customary to stain the etched plate black with a copper sulfate solution and polish the surface of the etched plate with charcoal as a visual aid in routing.

The individual engravings, or *cuts* are next mounted on wood blocks to make them type high (.918 in.) either by nailing them to the blocks, or they may be attached by means of rubber padding cement. The engravings are then ready for the printing press.

The photoengraving process undoubtedly sounds very complicated to the uninitiated. However, it can be broken down into four successive steps that can be mastered with perseverance and practice. The finished product will represent an achievement in the field of graphic arts which any school may be proud of.

TIMESAVER FOR THE PRINTING TEACHER

B. H. THOMAS
Central High School
Oklahoma City, Okla.

Most printing teachers feel that they spend far too much time in "waiting on" learners — searching for mislaid tools, and the like. No small amount of this wasted time is lost in teaching the operation of the platen press. Each press should have available at a convenient place guides, grippers, gripper and roller truck wrenches, sealing wax to seal guides, and matches. There should also be oiled tympan paper and various thicknesses of packing paper.

After many years of "where's this and where's that," we took time to design and make in the metal shop a drawer for each press. Now we know where the tools are, for it is more convenient to place them where they belong than to lay them here and there on the tables.

The illustration shows partitions spot-welded in. Space No. 1 is for matches; 2 for wrenches; 3 for guides and sealing wax; 4 for grippers; and 5 is a drawer stop to prevent pulling out the drawer too far.

To install, we raised the feedboard, marked position of feedboard screws, slotted the flanges for the screws, removed feedboard, set the pan (which holds the drawer) down so that the flanges on each side rest on the castings, and replaced the feedboard.

The drawing was made by one of the printing students, and the drawer was made in the metal shop.

The specifications on the drawing may be altered so that it can be placed at both ends of the bindery table, to hold the punch and the perforator.

ANIMAL GLUE — CHEMICALLY SPEAKING $C_{102}H_{151}O_{39}N_{31}$

Animal glue is an organic nitrogenous colloidal substance of the protein class. The development of protein and colloid chemistry has resulted in new techniques of production and application of animal glue. Possibly no other material has been used so extensively in the laboratory in demonstrating the colloidal phenomenon.

Commercial applications of the colloidal properties of animal glue can be found in the electro-metallurgic processes and dye baths. Glues have a pronounced stabilizing effect on most kinds of water oil emulsion. Hence, their use in oil type insecticides. Another common use occurs in the clarification of solutions. Through the principal of mutual precipitation, glue and the impurity combine and drop through the liquid, sweeping it clean. In a few processes, the suspended material is what is wanted. In such cases, the glue aids in concentrating it in the precipitate. The protective action of animal glue is used in electrolytic baths to prevent crystallization and thus aid in the formation of smooth hard deposits of metal.

Animal glues are highly reactive to almost all bases, salts, and acids. Undoubtedly, many of these reactions are due primarily to the dispersed state in which glue occurs in solution. Glue is a colloid and its colloidal nature governs its behavior under many circumstances.

The chemical nature of animal glue plays a role of ever increasing importance from the time raw materials are received in the glue plant until the glue becomes part of the finished product. A basic industry, linking farm and factory, glue manufacture provides a natural outlet for enormous quantities of by-products that come in large part from meat packers and tanners. This by-product production of animal glue provides tanners and meat packers with an important source of revenue.

Trained chemists and engineers oversee the man-sized job of converting one and one-half billion pounds of raw stock each year into well over 150,000,000 pounds of finished glue of various grades to meet the needs of industrial users. In similar fashion, technicians working in the plants of the users have developed controlled methods of application.

With a long life behind it, which began over 3000 years ago in Egypt, animal glue today is still the standard of all adhesives, versatile, simple to use, and dependable. The animal glue industry, like other progressive American industries, in its postwar plans is applying the soundest modern techniques to fit its own business into the pattern of a stable and prosperous America.

The glue manufacturer has taken advantage of all the practical revelations of research so far, by introducing them into the product or incorporating them into his production process. Experienced technicians with complete laboratory facilities at their disposal stand ready to assist the industrial user of animal glue on his specific and individual problem.

— National Association of Glue Manufacturers, Inc., New York City

WALL PLAQUE

EDWARD S. HAAS
Wilson Junior High School
Erie, Pa.

Here is an interesting woodworking project for beginners' classes. It requires but a few simple tools and a small quantity of materials. It is easy to construct and it is unusually ornamental. In addition, the unique manner of its construction imparts a professional appearance. The project can be used with equal success by industrial-arts classes, or by a group interested in whittling. All students engaged in its construction are learning what they must know about the grain of wood, and how to work with the grain properly.

BILL OF MATERIAL

No. of pcs.	*Material*	*Size*
1	Poplar, white pine, or bass	½ x 8½ x 8½ in.
1	Poplar, white pine, or bass	⅜ x 2 x 6 in.
1	Poplar, white pine, or bass	¼ x 3 x 10 in.
1	Screw eye	½ in.
16	Wire brads	½ in. No. 20
	Enamel	

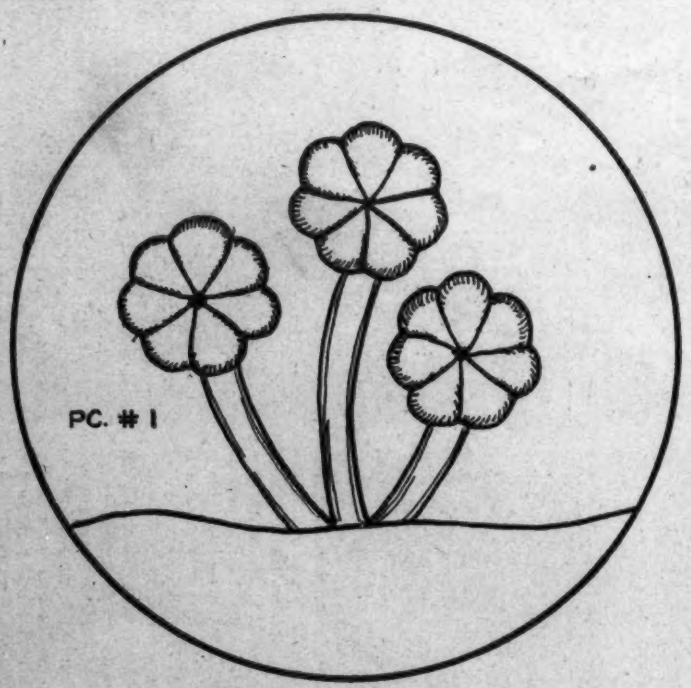
Procedure for Constructing of Plaque

Operation: Part No. 1, background circle

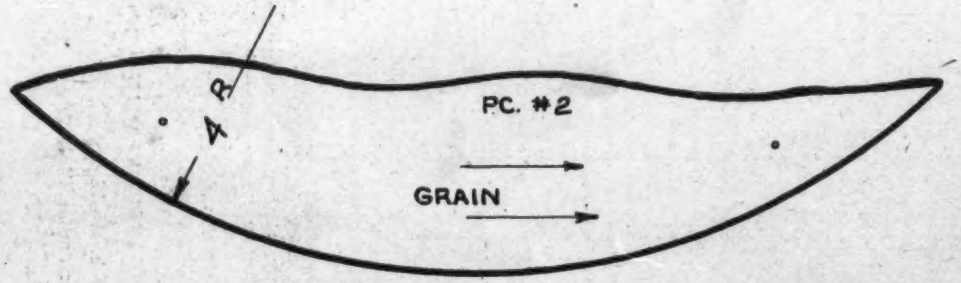
Step 1. Lay out an 8-in. circle on ½-in. stock.

Step 2. If a band saw or scroll saw is available, saw out circle, allowing a working margin on outside of circle line. If no power tools are available, use a coping saw or a circle saw, allowing the same margin of stock.

Step 3. Clamp the circle in a vise with the grain of the wood running vertically. Now



ASSEMBLED PLAQUE. HALF SIZE



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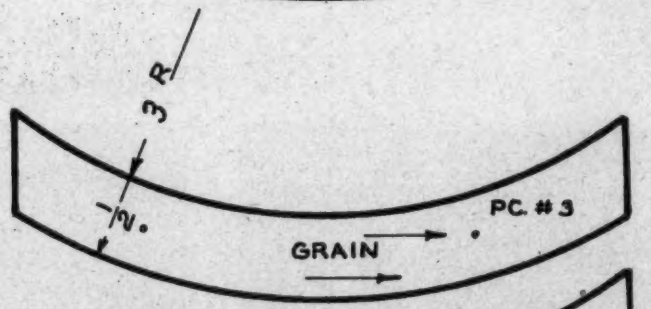


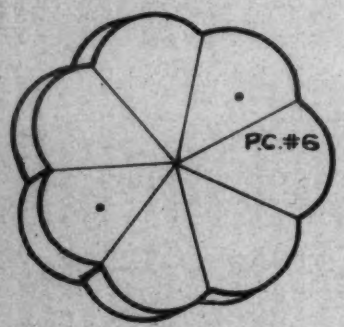


FIG. 1

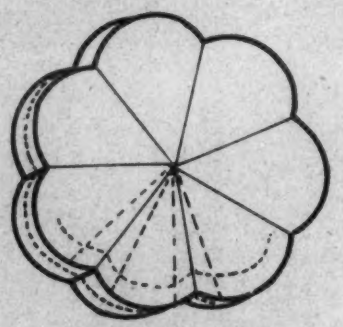


FIG. 2

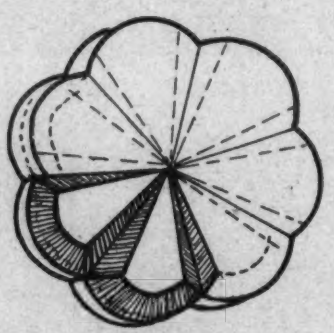


FIG. 3

A

FIG. 1

FIG. 2

FIG. 3

B

NOTE - ALL PATTERNS FULL SIZE

Wall plaque by Edward S. Haas

with a half-round file and using the flat side of the file, work off the working margin, filing from the edge of the grain toward the top. Reverse the circle in the vise, and proceed as before. This completes shaping of the circle.

Step 4. With a sandpaper block and No. 1 flint or No. 0 garnet sandpaper, sand this edge carefully until all file marks are removed. Then sand the face of the circle with the grain. (Sanding across grain leaves objectionable scratches.) Soften all edges and give entire circle one coat of shellac orange or white to prevent warping. Set piece aside to dry.

Operation: Part No. 2, ground piece

Step 1. Using full-size pattern, lay out Part No. 2 on ¼-in. stock, grain running lengthwise.

Step 2. Saw out by the same method used for Part No. 1, again allowing a working margin.

Step 3. Clamp piece in vise, and file off surplus stock.

Step 4. Again using sand block, sand off bottom edge of piece. Discard sand block, fold sandpaper twice, hold between thumb and first two fingers (this is called finger sanding) and sand off the wavy top edge of piece, until all file marks are removed. Now sand the face side with the grain, soften edges, shellac, and set aside to dry.

Operation: Part Nos. 3, 4, and 5. Stems

Step 1. Using full-size patterns, lay out pieces 3, 4, and 5 on ¼-in. stock, grain running lengthwise.

Step 2. Saw out the three stems allowing the usual working margin.

Step 3. File off the surplus stock.

Step 4. With a pencil and using the middle finger as a guide, draw the lines a-b shown in Figure 1 at B. Do this on each of the three stems.

Step 5. By using a sharp knife and by cutting with the grain, remove this stock as in Figure 2 at B.

Step 6. By removing corners c-d (B in Figure 2), a rough half-round will be obtained.

Step 7. Again finger sanding, and with the grain, continue sanding until all the knife marks are removed, and a symmetrical half round has been made, as at B, Figure 3.

Step 8. Shellac the stems and set aside.

Operation: Part No. 6, flowers (three required)

Step 1. Using full-size pattern, lay out Part No. 6 on ⅜-in. stock.

Step 2. Saw out the three pieces, leaving a working margin.

Step 3. File off surplus stock.

Step 4. Draw lines radiating from center of flower as at A in Figure 1.

Step 5. By following same procedure as used on flower stems (parts 3, 4, and 5) draw lines represented by dotted lines on each petal of flower as shown at A in Figure 2.

Step 6. Remove this stock with a sharp knife. See Figure 3 at A.

Step 7. Continue removing sharp corners until each petal is rounded, lengthwise and crosswise.

Step 8. Finger sand each petal until it is symmetrical.

Step 9. Shellac pieces and set aside to dry.

Operation: Enameling

Step 1. Select your color scheme.

Suggested: Ivory, white, or sky blue for Part 1. Light green for stems — Parts 3, 4, and 5. Dark green or brown for Part 2. Chinese red for flowers — Part 6.

Step 2. Sand each member carefully with No. 2/0 flint sandpaper.

Step 3. Dust each piece thoroughly with a brush. (Rags leave lint).

Step 4. Stir enamel if necessary and with a soft brush apply a light coat to each piece.

Step 5. When dry, sand lightly again, dust, and apply second coat.

Operation: Brads

Step 1. Select about 18 No. 20 by ½-in. brads.

Step 2. Place each brad in a machinist's vise, point down, and file another point on the head end. Use a mill file for this operation.

Operation: Assembling

Step 1. Drive two of these double pointed brads into Part 1, at the location represented by dots on Part 2. Drive them in slightly more than half their length.

Step 2. Line up edges of Parts 1 and 2, and press firmly together. This holds the pieces together without showing any nail holes.

Step 3. With a coping saw cut one end of the longest stem to fit into the curve of the ground piece. Now cut the top end to fit against the edge of one of the flower petals. It may be found necessary here to do a little trimming on the stem's ends with a knife or a rattail file.

Step 4. Place the stem and the flower in their approximate positions on the circle, mark the location for brads, drive brads into the circle halfway, press stem piece home, followed by flower.

Step 5. Repeat the same process for attaching the remainder of the stems and flowers. The exact location of all pieces is left to the student's discretion.

Step 6. Attach screw eye near top of back of plaque.

QUESTIONS FOR DISCUSSION

What is a working margin?
What is meant by the grain of the wood?
Why is it necessary to cut with the grain?
What is the difference between garnet and flint sandpaper?
What is meant by softening corners and why soften corners?
What is finger sanding and what are its advantages?
What advantage is there in enameling the separate parts before the project is assembled?

KEEP UP THE SCHOOL SAVINGS PLAN

A nationwide survey shows that men and women of both rural and urban centers want the opportunity to save regularly through the purchase of U. S. Savings Bonds. Asked about the continuation of the sale of stamps at school, 82 per cent of the parents contacted, replied that they would like their children to have the opportunity to save through stamp purchase at school.

In addition, 80 per cent of these parents want their boys and girls to learn about savings bonds, what they are, and why it is advantageous to the individual to save regularly.

In a survey of four Cleveland high schools, more than four out of five students stated that they would like to have some sort of savings plan in their schools now that the war is ended.

To substantiate their vote of confidence in continued school savings, parents voluntarily listed certain educational advantages which their children can gain from a regular stamp day. Sixty-two per cent of the parents who were interviewed stated that the opportunity to save in school teaches children good habits of thrift — an objective of importance. Another 5 per cent mentioned stamp day as a time to develop a sense of responsibility in boys and girls who must be able to manage their own saving and spending. Ten per cent stated that lessons in personal saving help to develop in children a greater sense of the value of money.

In answer to this clear-cut demand of the country as a whole, the Treasury Department has announced that stamps and bonds will remain on sale indefinitely, and that the payroll savings plan will be continued in many of the industries and business firms of the nation. Throughout the country teachers and school administrators are converting their war savings program to a permanent school savings program to promote better understanding of the personal and national reasons for continued saving and to provide the opportunity for students to save regularly at school.

WELDING CRACKED CYLINDER BLOCKS

The block job, shown in the illustration, had 37 inches of cracks and a piece that had fallen out completely. It constituted an excellent job for a welding student at The Hobart Trade School, Troy, N. Y.

The welding almost completed

The first step was to clean the parts to be welded. Then the cracks were chipped out to approximately ⅛-in. *V* with the use of a bantam weight air hammer and chipping tool. All three sides of the loose piece were beveled to form a *V* with the sides of the opening.

All welds were made from the start of the cracks to the open end at the rear of the block. To weld in the opposite direction would have resulted in considerable accumulated stress being locked up at the start of the cracks. Hobart Soft-Cast A electrodes were used and they produce a very dense, yet soft weld that can be peened so effectively to practically eliminate shrinkage. The time at which peening is started is of utmost importance, so beads were kept short, between ⅛ in. and 1½ in. in length. All peening was done with a bantam weight air hammer and peening tool. The peening was started the instant the deposited metal lost color and turned to a black heat. Welding was not resumed after peening until the operator could hold his bare hand on the weld. The casting quickly draws the heat from the short welds.

After the loose piece was welded in, the beads were ground to remove any surplus bead metal. The whole job was run without a crack or a cross check and the repair was permanent. Total repair time for this particular job was seven hours.

PICTORIAL ASSEMBLY DRAWINGS

D. C. Black*

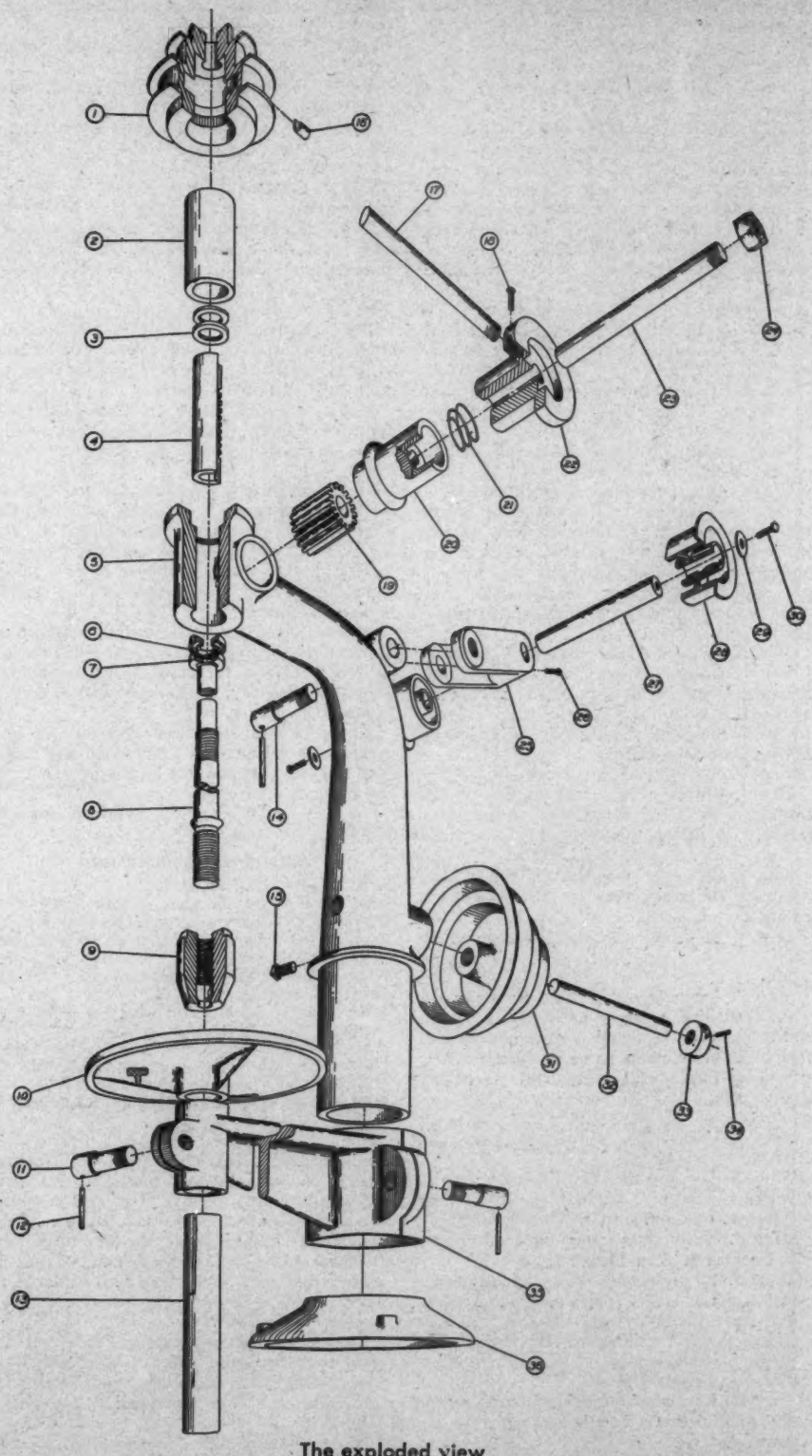
Orthographic projection is the accepted method of shape determination. However, this method of view drawing has its limitations as a means of conveying a unified picture. This is especially true of the skilled worker who has only occasional need to refer to blueprint information. Draftsmen have endeavored to illustrate more simply by use of freehand, shading, and added section views. Even with these added features, views or projections may cause confusion instead of simplifying the illustration.

In classes of high school students studying drafting the pictorial method of approach is sometimes the answer to clarity and understanding. When they begin selecting the view to be drawn much thought and a few "dry runs" may be necessary using a plain over-all box shape, equal in size to the over-all dimensions of the assembly. The choice of view will be similar to that selected by a photographer. Choice of scale is determined by size of parts, wall thickness, and number of parts in the assembly.

The treatment of the pictorial assembly is next considered. Should parts be left full sectioned, half sectioned, or torn sectioned? Will exploded sequence of individually drawn parts be advisable? These and other questions are in order at this phase of the drawing. The actual drawing and planning of the circular shapes is one of the difficulties of this type of illustration. Many parts are cylindrical and the drawing of a multitude of ellipses entails much construction and repetition before the illustration develops its final form. Templates are available for series of graduated sized circles. However, the minor diameter of a circle may have many dimensions depending on the station point of the eye, above or below the edge of the circle. The construction should remain on the student's drawing. It is valuable evidence of correctness of construction. Another type of detail requiring skill is the illustration pictorially of screw fastenings. The threads appear as overlapping ellipses, and if not drawn uniform the irregularities are quite apparent. Often the appearance will depend on the student's skill in manipulation of various French curves. Other parts of the work will depend on student skill, methodical procedure, ability to visualize through a maize of construction, and accuracy of method.

Some of the usual methods of pictorial illustration are: isometric, dimetric, oblique, cabinet, perspective, trimetric. There are also many variations of these methods that can be utilized for individual applications. Each problem must be analyzed individually and if orthographic projections do not illustrate various parts in a simple manner, positions, and combinations of pictorial, may improve the image to the reader.

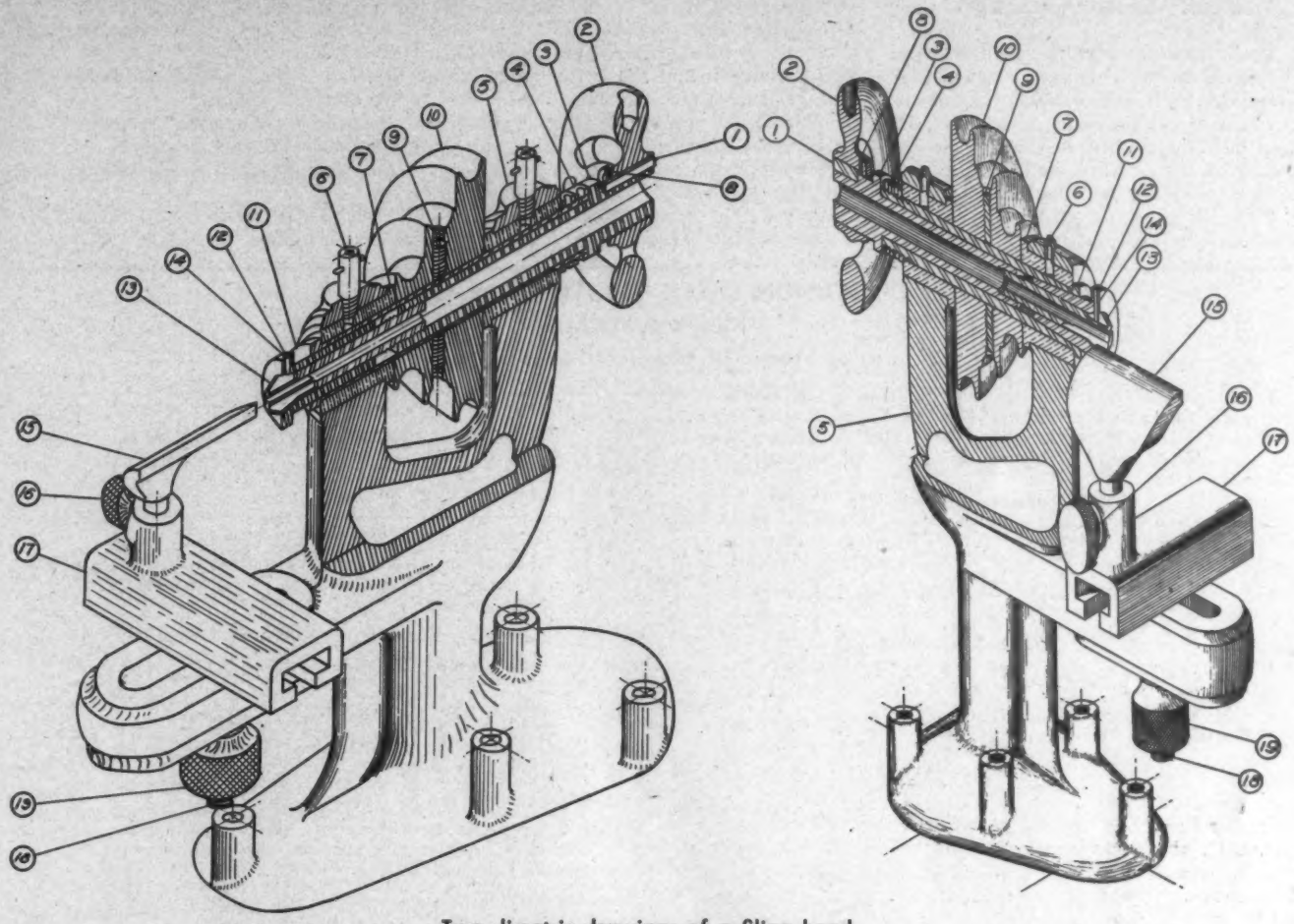
*Detroit, Mich.



The exploded view

Checking of shape and dimensions on details, also is accomplished by pictorial assembly drawing.

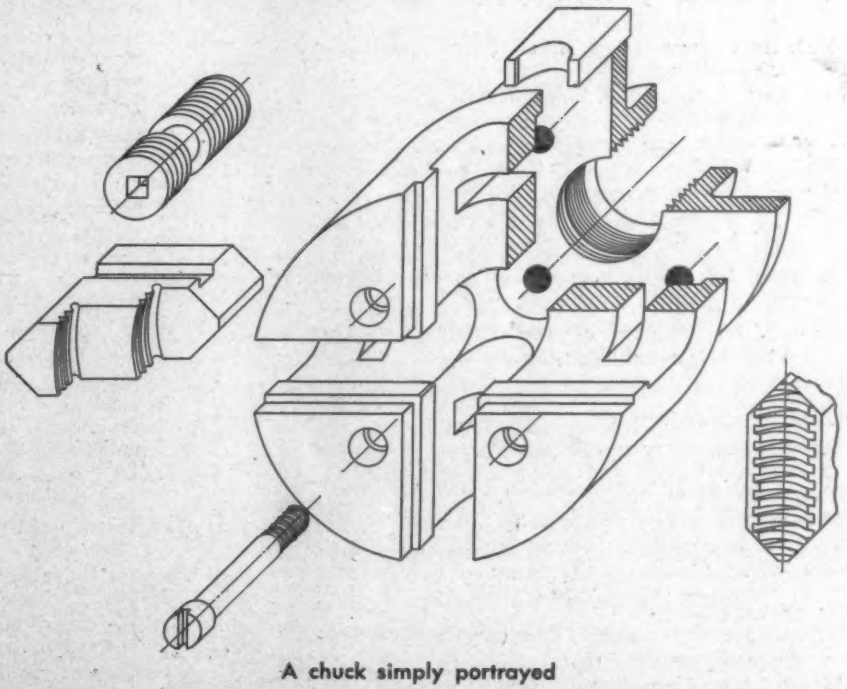
The drawing of the drill press illustrates the explosive method of placing details in locations adjacent to their place relative in assembly. The details farthest away are those assembled last. Common center lines also aid in aligning parts assembled together. This drawing also shows the eye line below the drill press; that is, we are looking up at it. The method used was dimetric. A box was drawn in lightly, using the over-all dimensions of the assembly.



Two dimetric drawings of a filing head

Measurements were laid off on the right and left base lines and on the height line. Any spot in the assembly can be located by dimensions and offsets constructed, giving intersections locating the spot, similar to locating points on graphs x, y, z axes. Squares in perspective are drawn to box ellipses, that represent circular shapes.

The filing head shows two drawings both are in dimetric. They represent the same assembly. It is noticeable that the heights are similar, but the lengths and widths on one drawing seem compressed. The reason is that the scale used for width and length was one half of that used for height, while on the second drawing the width and lengths were three quarters of that used for the heights. The sectioning illustrates an important part of the construction and assembly of the machine. This section in an orthographic projection has been troublesome for students to understand but the pictorial assembly overcomes the difficulty of collecting the several parallel lines into the various tabular and rod shapes.



A chuck simply portrayed

The chuck illustrates the simple way of drawing circles not as ellipses but as true circles. This method applies to simple cylindrical shaped parts with the circles all in one plane. Threaded parts both internal and external need extra student care in spacing and retaining the centers exactly on center line. Half sectioning is effective illustrating intersection of the four 90-deg. slots holding the jaws. The amount of metal sectioned is noticeably thin. Cen-

ter lines add in the illustrating of hole depth.

These drawings were made in advanced classes of machine detailing classes at Cass Technical High School, Detroit, and the methods of orthographic or pictorial are used interchangeably depending on the nature of the problem, and the use that is to be made of the drawing.

Pictorial gives us another vehicle in teaching machine construction, operation, and assembly. It is in the process of development and some day will take its place along with orthographic as means of describing certain shapes to better advantage than is now possible. For further reference a list is given of printed matter on pictorial drawing.

New Approach to Axometric Projection and Its Application to Shop Drawing, *Bulletin A & M Texas College*

Axonometric Production Illustration, Glen L. Martin Co., Baltimore, Md.

Air View System of Drawing, McQuaid, Denver, Colo.

Aircraft Sketch Book, Lockheed Aircraft, Burbank, Calif.

Drafting for Engineers, Svensen

Technical Drawing, Giesieke

Industrial Production Illustration, Hoelscher

Principles of Perspective Drawing, *Machinery Magazine*

SELF-EVALUATION CHECK LIST FOR SHOP TEACHERS

JOSEPH A. SCHAD

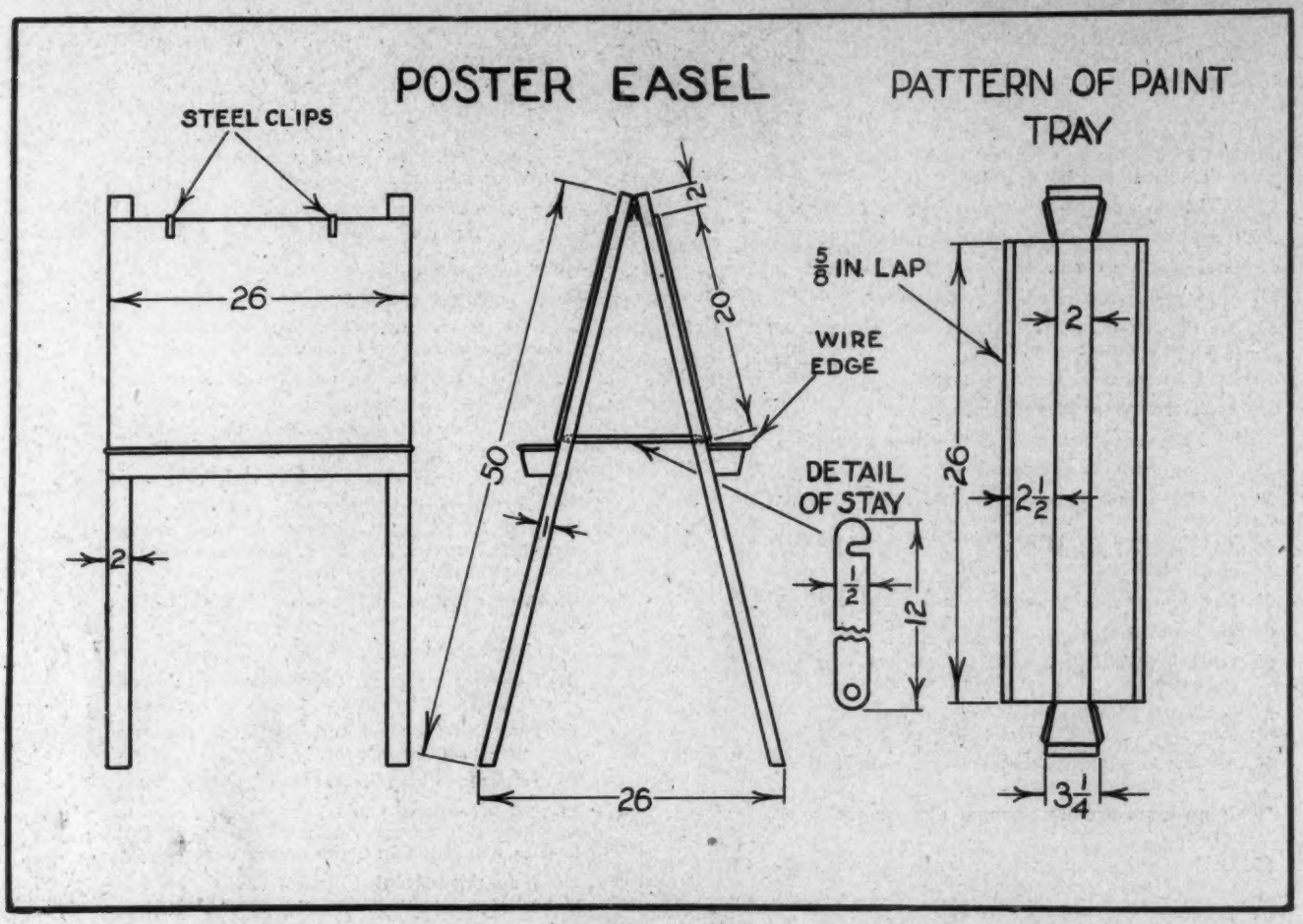
Director of Vocational Education, Newport News, Va.

The purpose of this check list is to stimulate self-improvement of instructors through an evaluation of the items listed. It is suggested that each instructor appraise these items very carefully, placing in the appropriate column a check mark to indicate the degree of performance.

Self-Evaluation Check List

	Always	*Frequently*	*Occasionally*	*Rarely*
1. Do I correct the pupils when they use poor English?				
2. In written work, do I require the pupils to meet the same standards of composition and expression that the teachers of English require?				
3. Do my pupils check out the books from the library that have been purchased for my activity?				
4. Do I take my class on excursions to industrial plants?				
5. Do I have displays in local store windows?				
6. Do I have displays of work in my classroom?				
7. Do I display the work performed by each pupil?				
8. Do I invite the parents of my pupils to visit the shop?				
9. Do I have key persons from industry make talks to the pupils?				
10. Do I invite other instructors to make special talks to my pupils				
11. Have I varnished, painted, or cleaned my workbenches, tables, tool panels, drawing boards, bulletin boards, shelves, lockers, and walls recently?				
12. Do my pupils ask if they may work after school or during study periods?				
13. Is my fire fighting equipment in proper working order?				
14. Is my first-aid cabinet complete and clean?				
15. Do I use an accident report form?				
16. Do I ask the supervisor for help in solving problems?				
17. Do I welcome constructive criticism?				
18. Have I made any specific improvements during the year in course content, in shop management, in arrangement of equipment, and in record control?				
19. Have I revised my written instruction sheets lately?				
20. Do my pupils have a written assignment following the completion of each drawing plate or shop project?				
21. Do I use lesson plans?				
22. Do I have posted a list of references for each operation or process taught?				
23. Do I have a comprehensive list of the things to be taught (not jobs)?				
24. Are all the tools in my shop in first-class condition?				
25. Are my pupils using their tools properly?				
26. Do I instruct or do I actually do the work that the learner should be doing? (Not to be confused with the demonstration)				
27. Do I give objective tests once or twice a week?				
28. Are utilitarian jobs or projects being made by my pupils?				
29. Are films, slides, and strips used as a teaching aid?				
30. Do I have a clear understanding of the specific objectives of my course?				
31. Do I consider telling "teaching"?				
32. Are my pupils using blueprints, sketches, job plans, job sheets, specification manuals, and textbook references for each and every job?				
33. Am I trying to use a textbook as a course of study?				
34. Do I have equipment and material ready before giving a demonstration?				
35. Is my activity so organized that a substitute instructor could carry on the work in an effective manner?				
36. Do I prepare daily lesson plans?				
37. Do I have a clear understanding of the meaning of preparation, presentation, application, and testing?				
38. Do I take the position that lesson plans are not needed in my class?				
39. Do my pupils plan their projects based on the operations or processes to be taught or do they perform a series of exercise or practice jobs that ultimately find their place in the scrap box?				
40. Do my pupils know what they are making?				
41. Do I have a clear-cut objective for each lesson?				
42. Do my lessons usually require more than twenty minutes?				
43. Do I have an objective method of rating tests, projects, or drawings?				
44. Do I require the pupils to come to the desk to have work evaluated?				
45. In my daily teaching do I provide for individual differences?				
46. Do I give an oral or written quiz after showing a film?				
47. Do I have posted in the shop a list of available material and cost?				
48. Does my project record card show the number of jeweler saw blades, tool bits, drawing paper, and quantity of abrasive materials issued to the individual pupil?				

	Always	Frequently	Occasionally	Rarely
49. Am I using project record cards which list the material that the job requires?				
50. Do I have a progress chart displayed in the shop?				
51. Is my course of study posted in the room?				
52. Have I collected all shop fees?				
53. Are my financial records in good order?				
54. Are the record cards or bills of material made out in a neat and orderly manner?				
55. Do I have a good inventory system?				
56. Am I prompt in submitting reports?				
57. Do I allow machines to be used without guards?				
58. Are my machines well guarded?				
59. Are the guards on my machines in good working order?				
60. Are machine guards in place and are they being used by the pupils?				
61. Have I rearranged the equipment in the room lately?				
62. Do I lose tools?				
63. Do I have a collection of tools that always need resharpening?				
64. Is there a place for every tool and accessory in the shop and is the tool there at the close of the period?				
65. Are my workbenches cluttered with tools, materials, parts, machine accessories, and the like?				
66. Is my equipment so arranged that balance is preserved?				
67. Do I have a parental permit for the use of machines for each pupil under my supervision?				
68. Do I see to it that tools are not misused?				
69. Do I check all jobs from the standpoint of safety before allowing a pupil to proceed with them?				
70. Do I have safety regulations posted at each machine?				
71. Do I permit certain machines and tools to be used before giving a demonstration?				
72. In my tool checking system do I use checks or written requisitions?				
73. Do I rotate my cleanup jobs?				
74. Do I have posted in the shop a cleanup assignment chart?				
75. Do I have a staff of student executives?				
76. Do my officers do the routine work?				
77. Do my officers wear identification badges?				
78. Do I employ the personnel system of shop management?				
79. Do my officers know what their duties are?				
80. Are my stock cabinets arranged in an orderly manner?				
81. Do I leave items on the floor overnight?				
82. Are my tools so arranged that I can tell at a glance whether everything is in?				
83. Do I have one or two central places for my tools, equipment, and accessories or do I have an item here, there, and everywhere?				
84. Can I be proud of the way my tools are displayed on the tool panels?				
85. Are the tools on the panel hung properly and has a system been used in arranging and securing the tools to the panel?				
86. Are the materials on my bulletin boards changed at frequent intervals?				
87. Is my desk clear when I leave at night?				
88. Are my blackboards erased at the close of the day?				
89. Is my office and storage room cleaned daily?				
90. Do all my pupils wear aprons or the equivalent?				
91. Do I set the example by wearing the same type of protective clothing that I require of the pupils?				
92. Do I have more than one pupil out of the room at one time?				
93. Do I dismiss my class as a class or do they leave anytime before or after the bell rings?				
94. Do I have a definite place for the students to be at the beginning of the period?				
95. Do I allow the pupils to enter the shop and go immediately to work or do I have them meet at some central place daily?				
96. Is there a signal in addition to the dismissal bell for cleanup?				
97. Do I have appropriate racks for my supplies?				
98. Do I see that my pupils work in comfortable positions?				
99. Do I see that the pupil works in the right position from the standpoint of light?				
100. Do I attempt to keep breakage down to a minimum?				
101. In case of absence would your pupils say to the substitute, I don't know what the next job is I'll have to wait until Mr. Smith returns to school?				
102. Do I do the work that students should be doing under the pretense that the boys cannot do it?				
103. Do I take steps to remedy unsatisfactory teaching conditions or do I accept the *status quo*?				
104. Do I take the attitude — that won't work in my shop?				
105. Do I keep my pupils busy at all times?				
106. Do I leave the classroom during the class period?				
107. Will my shop pass the type of inspection the armed services require?				
108. Do I ask my pupils for suggestions or ideas as to how the course might be improved?				
109. Have I provided satisfactory storage facilities for my projects?				
110. Do I study the layout of my shop from the standpoint of making improvements?				
111. Do I read at least one professional book a year?				
112. Do I subscribe to professional periodicals?				
113. Do I support my professional organizations?				
114. Do I attend local, state, and regional meetings of vocational teachers?				
115. Do I co-operate with the teachers in the department?				
116. Do I have to apologize when visitors ask to see some of the work?				
117. Do I speak to the pupils in a pleasant tone of voice?				
118. Do I get excited or angry with the pupils?				
119. Am I available after school hours to help pupils with their work?				
120. Do I follow proper lines of authority?				
121. Do I use teaching aids other than visual materials?				



Details of the poster easel

The poster easel

POSTER EASEL

CHARLES F. ZAENGLEIN
High School
Circleville, Ohio

Sometime ago our industrial-arts department constructed several poster easels which were quite simple in construction and the cost was very reasonable.

The paint trays were fastened to the easel with r.h. screws. The stays were drilled at one end to take a No. 10 by 1¼-in. r.h. screw and slotted at the other end to slip over a 1¼-in. r.h. screw.

The easels can be folded together when not in use to conserve space. The steel clips which hold the paper can be made of 28-gauge black iron.

The legs were finished in mahogany. The 3-ply was painted white ivory. The stays and clips were painted black and the paint trays were painted with aluminum paint.

The easels shown in the illustrations were designed for kindergarten and first-grade pupils. For high-school pupils add 12 to 14 in. to the legs.

BILL OF MATERIAL

No. of Pcs.	*Material*	*Size*
4	Softwood uprights	1 x 2 x 50 in.
2	3-ply softwood	¼ or ⅜ x 20 x 26 in.
2	Strap hinges	4-in.
2	Flat irons	⅛ x ½ x 12 in.
1	Galvanized sheet metal — 28 ga.	8¼ x 32¼ in.
2 lengths	No. 9 galvanized wire	60 in.

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The Chevrolet Motor Division of General Motors Corporation, cosponsors with the nation's leading newspapers, and Chevrolet dealers of what has come to be acknowledged as America's greatest sports event for boys, announces the resumption of the All-American Soap Box Derby.

This popular amateur racing event will encompass local competition in more than 130 cities from coast to coast for tens of thousands of boys between the ages of 11 and 15 years. The national finals will be held in Derby Downs, Akron, Ohio, next August.

The Derby is a coaster wagon race for boys, aged 11 to 15, inclusive. Local races are sponsored and conducted by leading, pro-

(Continued on page 18A)

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Each of your students should have a copy of the Disston Saw, Tool and File Manual. It tells how to choose, use and care for tools. Copies will be supplied to them free by your local hardware retailer.

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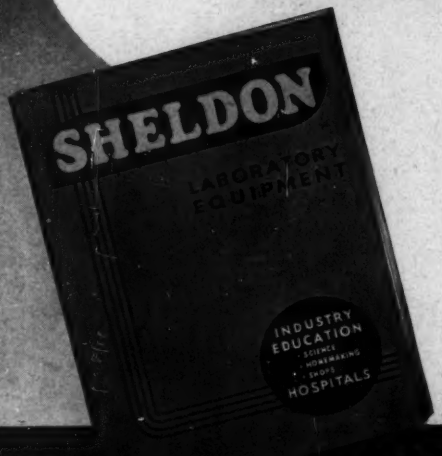

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(Continued from page 190)

gressive newspapers in the country's principal cities with the aid of Chevrolet and Chevrolet dealers, under national rules supervised by a National Technical Committee.

Winners of local events receive the M. E. Coyle trophy, a medal presented by the general manager of Chevrolet to signify the boy's victory. In addition, he wins a trip to the national finals at Akron.

The victor of the Akron finals receives a scholarship to any approved state college or university of his choice. In addition, supplementary prizes including trophy awards for the best designed car, best designed brakes, best upholstered car, and winner of the fastest heat, are features of the annual finals which draw crowds aggregating more than 100,000 people. Derby race cars must be built by the boys who pilot them and must not cost in excess of $10, thus placing all boys on an equal footing regardless of family circumstances.

Entrance to local races is free to all boys. Entry blanks and rule books, containing valuable derby car-building tips and other information are now in the process of preparation and shortly will be available to entrants through sponsoring newspapers and cosponsoring Chevrolet dealers.

Official colorful driver's safety helmets will be given to each boy participating in local races. The nation's local champions who make the trip to Akron, Ohio, will receive a complete racing outfit there. In addition, each boy competing in the national finals will receive a valuable, suitably engraved award and emblematic of his participation in young America's most colorful classic.

For further data address Chevrolet Motor Division, General Motors Bldg., Detroit 2, Mich.

Personal News

DR. J. C. WRIGHT TO RETIRE

Many of those who attended the A.V.A. convention at Buffalo heard with deep regret that Dr. J. C. Wright, long-time head of vocational education in Washington, will reach the retirement age on June 30 next.

Dr. Wright has spent 51 years of his life in educational work, and he devoted 40 years of this time to vocational education.

Dr. J. C. Wright

Commissioner Studebaker says of his retiring assistant commissioner for vocational education:

"Dr. Wright has served the nation faithfully and well, first as director of vocational education under the old federal board for vocational education and later as assistant commissioner for vocational education in the U. S. Office of Education. His three decades of service were distinguished by soundness of judgment, integrity of purpose, and administrative ability of a high order."

Dr. Wright, from the very start, was one of the leaders in the vocational education field and he was associated with such other leaders as Dr. Charles A. Prosser, Charles R. Allen, and R. O. Small who shaped up this field of education into the efficiently working development it now is.

He is the author of many books and magazine articles in the vocational field and has been influential in all of the vocational legislation of the past.

His personality and his influence will be sorely missed.

Appointed Chief of Radio Education

Dr. Franklin Dunham has been appointed chief of radio education in the U. S. Office of Education, by Dr. John W. Studebaker, U. S. Commissioner of Education, Washington, D. C.

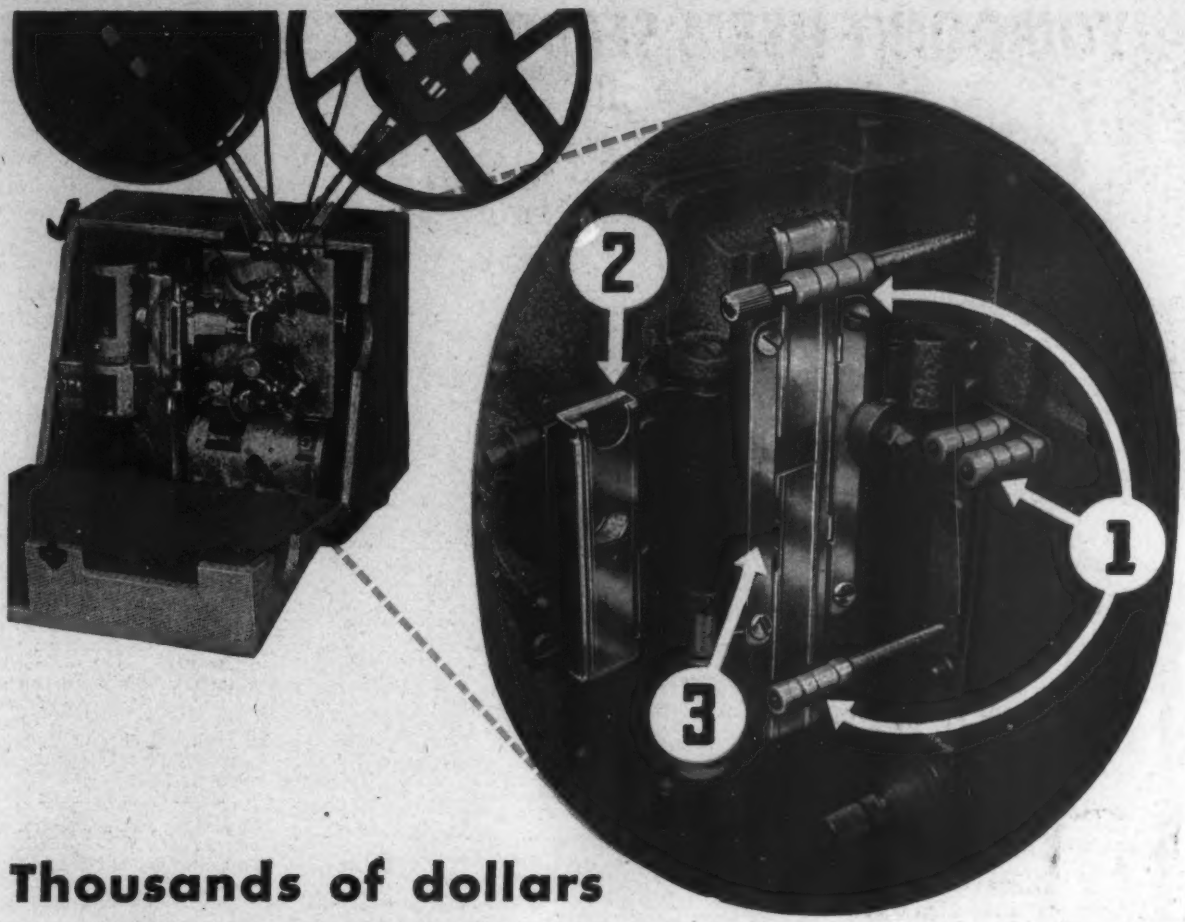
Dr. Dunham has been the educational director of the National Broadcasting Company for many years, and served as special consultant in radio education to the Secretary of War during World War II.

ROWNTREE JOINS PENN STATE STAFF

Urwin Rowntree has been appointed associate professor of industrial education at The Pennsylvania State College, State College, Pa.

Mr. Rowntree is a graduate of The Pennsyl-

(Continued on page 20A)



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(Continued from page 18A)

vania State College. For the past three years he has served as Lieutenant Commander in the U. S. Navy as vocational training officer, Potomac River Naval Command, with office at the Navy Yard in Washington, D. C. Prior to this he served for 2½ years as chief of industrial education of the department of public instruction in Pennsylvania. Mr. Rowntree brings to his new position a valuable and well-rounded industrial and professional experience. He will offer courses both on the campus and by extension in the service area of the College.

W. T. MARKHAM DIES

W. T. Markham, state supervisor of occupational information and guidance for the state board of vocational education, Topeka, Kans., died suddenly on January 18, 1946.

Mr. Markham was born in a log cabin in the hill country of Virginia, and came up through every field of educational activity to become state superintendent of public instruction in Kansas. In 1939 he was appointed state supervisor of occupational information and guidance.

He was an indefatigable worker. The day previous to his death he made four speeches in Hugoton, Kans. On the day of his death he talked to a high school group in Moscow, Kans. From Moscow he drove to Dodge City, parked his car, and went to a doctor's office where he died a few minutes later, apparently without pain or struggle. All of Mr. Markham's many friends, especially those engaged in education, pay tribute to a beloved educator.

DR. RAYMOND W. GREGORY TO SUCCEED DR. WRIGHT

Dr. Raymond W. Gregory has been appointed to succeed Dr.. J. C. Wright as assistant commissioner for vocational education in the U. S. Office of Education, effective as of July 1, 1946.

Dr. Gregory has been a member of the staff of the agricultural education service in the vocational division of the U. S. Office of Education since 1936. During the recent war he had immediate charge of the administration of the food production war-training program. Under this program 200,000 training courses, enrolling approximately four and a half million persons, were organized and conducted by local public school systems

Dr. Raymond W. Gregory

operating under state boards for vocational education with emergency appropriations made available through the U. S. Office of Education. This food production war-training program, conducted in approximately 15,000 rural communities, did much to help the farmers of the nation break all records for agricultural production, despite manpower shortages. More recently Dr. Gregory has been serving as deputy director of the division of surplus property utilization of the Office, in charge of program planning.

♦ EARL L. BEDELL, divisional director of vocational education, Public Schools, Detroit, Mich., was elected president of the National Council of Local Administrators of Vocational Education Association at its annual meeting held at Buffalo, February 5, 1946.

♦ WELCOME E. WRIGHT has been appointed professor of industrial-arts education at the A. & M. College of Texas, College Station, Texas.

Mr. Wright assumed his duties on February 18. He received his B.S. degree from the East Texas State Teachers College, Commerce, Tex., in 1932, and his master's degree from the A. & M. College of Texas in 1939. His teaching experience includes seven years as industrial-arts instructor at Whiteoak, Tex., and three years as director of industrial arts at the Longview, Tex., High School. Both of these schools are located in the oil area of the state. In 1942 he resigned his position at Longview to accept a position as a draftsman for the Consolidated Vultee Aircraft Corporation at Fort Worth, Tex. He served as a draftsman in this department for almost one year, after which he was promoted to division foreman. Following this he was elevated to the department of aeronautical research, as a testing engineer, which position he held until his appointment at the A. & M. College.

♦ WILLIAM P. GREEN has been reappointed supervisor of trade and industrial education at St. Joseph, Mo. He held this position before he joined the armed forces.

♦ ARNOLD W. EMBREE has been appointed coordinator at Central High School, St. Joseph, Mo.

♦ WALTER BROWN has been mustered out of the armed forces and is returning to his old position as co-ordinator-supervisor at Hannibal, Mo.

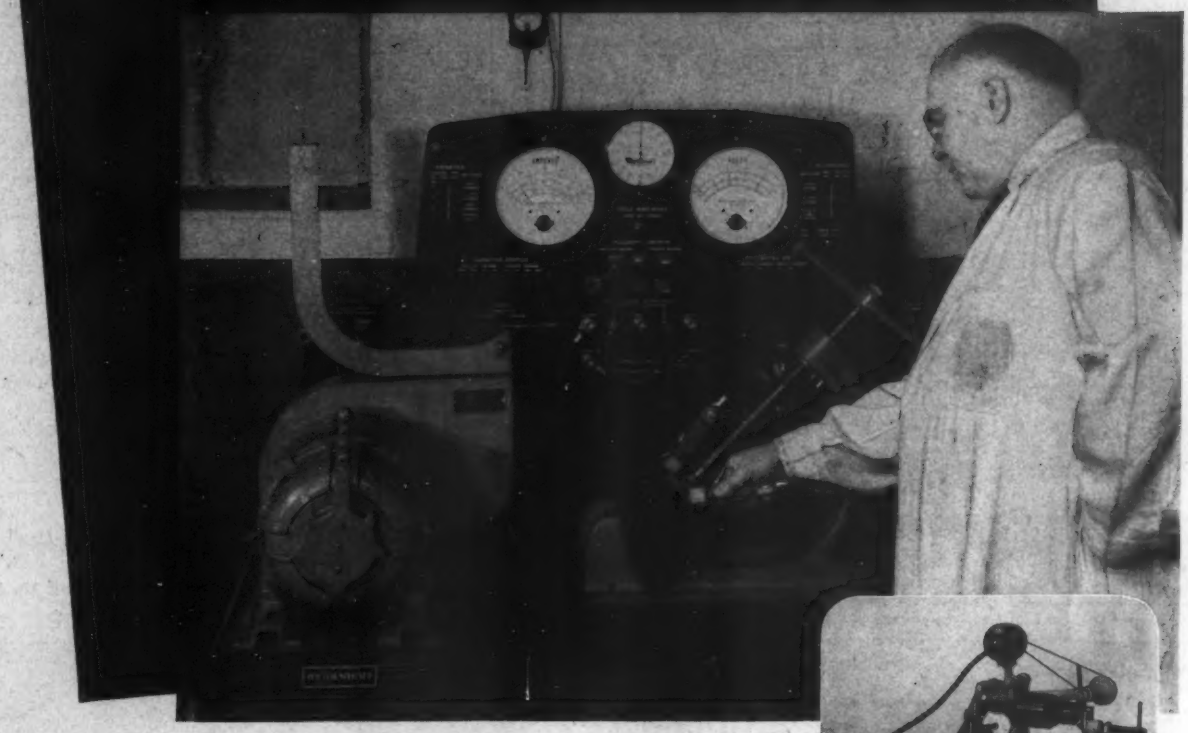
♦ GORDON RENFROW has been appointed director of the new division of veterans education in the State Department of Education, Jefferson City, Mo.

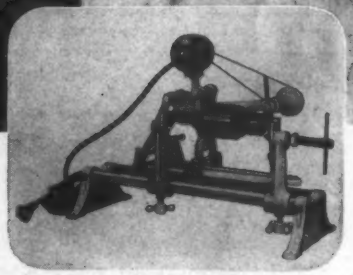
♦ CHRIS W. JUNG, recently discharged from the armed forces, and former principal of the Senior High School, Warrensburg, Mo., has been appointed co-ordinator of the diversified occupations program just organized at the high school just mentioned.

(Continued on page 23A)

TEACH with the TRADE'S EQUIPMENT CHOICE—

WEIDENHOFF





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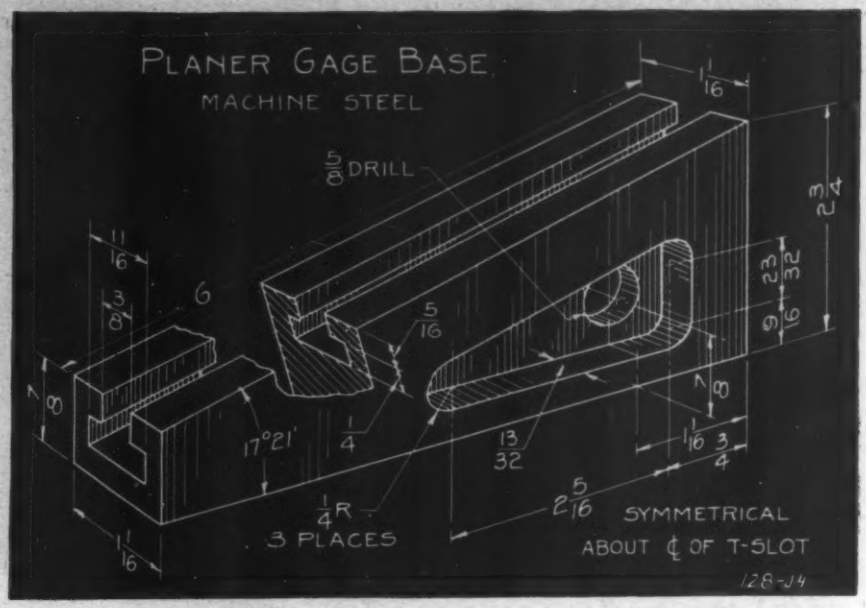

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(Continued from page 20A)

♦ GEORGE N. SCEETS, 58, teacher at the Milwaukee Boys' Technical High School, Milwaukee, Wis., for 21 years, and head of the automobile mechanics department there for 20 years, died on February 23, 1946.

He was born in Chicago but came to Milwaukee as a child. Before coming to Boys' Tech, he taught at the old Milwaukee Motor School for several years.

Mr. Sceets is survived by his wife, a son, and three daughters.

♦ ROBERT W. REESE, well known in the state of Indiana as assistant supervisor of war-production training, and later as assistant supervisor of trade and industrial education, was recently appointed state supervisor of industrial education for the state of Ohio. Mr. Reese is a graduate of Ohio State University, and recently received his master's degree from Purdue University.

Mr. Reese developed a fine program of trade extension as director of vocational education at Connersville, and later established an excellent record in the state office during the difficult days of war-production training.

♦ LUCIAN COX, former drawing teacher in the Bloomington High School, has recently received his discharge from the navy and in all probability will resume his position in the schools of Bloomington, Ind., next fall.

♦ LLOYD VAUGHN is teaching industrial arts at Clinton, Ind.

♦ GLEN DIEL, formerly of the U. S. Army, is now teaching in the industrial-arts program at Columbus, Ind.

♦ WILLIAM FEGLY is teaching industrial arts and physical education at Covington, Ind. Mr. Fegly was graduated from Indiana State Teachers College in 1942 and served for three and a half years in the army.

♦ GERALD MCGHEE is teaching machine-shop practice at Dugger, Ind.

♦ JACOB THOMPSON has been appointed teacher of industrial arts at Farmersburg, Ind.

♦ DALE MODISETT is teaching industrial arts at Hillsdale, Ind. Following his graduation from Indiana State in 1941, he taught vocational machine shop at Oblong, Ill. From there he went to Chanute Field where he completed extensive training courses in airplane mechanics and the link trainer. He then remained at Chanute Field as instructor in each of these fields until the spring of 1945.

♦ JOHN CRICK has been appointed principal of the Kingman School, Kingman, Ind. He taught industrial arts at Cayuga, Ind., for several years after his graduation from Indiana State. He has no industrial-arts work at Kingman at present, but hopes to have a program very soon.

♦ JAMES GREEN has been appointed to teach the Roosevelt General Shop at Kokomo, Ind. Mr. Green is a graduate of Indiana State Teachers College.

♦ T. D. PETERSON has been assigned to the Lebanon High School industrial-arts program at Lebanon, Ind.

Association News

THE THIRTY-NINTH ANNUAL A.V.A. CONVENTION

The Hotel Statler at Buffalo was thronged with vocational educators during the week of February 4 to 9 when the American Vocational Association held its thirty-ninth annual convention.

It is true, the convention proper did not open until the sixth, but special meetings were held as early as Monday, February 4, at 9:30 a.m.

The National Council of Local Administrators of Vocational Education and Practical Arts carried on its deliberations throughout Tuesday and Wednesday. In these sessions the problems of the vocational school, the engineering college, the technical institute, and the college extension service were thoroughly discussed, as was also the problem of surplus materials and equipment and how to obtain it.

Veteran training, guidance, placement, and follow-up, also were studied.

At the business meeting, Earl L. Bedell, director of vocational education for the public schools of Detroit, Mich., was elected as president for the coming year. Principal William B. Kamprath of the Burgard Vocational High School, Buffalo, N. Y., was chosen a member of the executive board.

The officers of the State Vocational Associations held their meeting on Wednesday afternoon.

L. H. Dennis, executive secretary, American Vocational Association, Inc., Washington, D. C., was chairman, and Verne Bird, president, New York State Vocational and Practical Arts Association, Rochester, N. Y., was the assistant chairman of this section.

At the business meeting, G. F. Liebendorfer Lincoln, Neb., was elected vice-president.

The National Association of Industrial Teacher Trainers held three meetings during the convention.

The meeting on Tuesday morning, February 5, was under the chairmanship of S. Lewis Land, secretary-treasurer of the association, and head, department of industrial education, The Pennsylvania State College, State College, Pa.

At this meeting "Curriculum for Training Industrial Teachers," was discussed by Gilbert G. Weaver, state supervisor of industrial teacher training, New York City; and R. W. Howes, state supervisor of industrial education, Hartford, Conn., spoke on "Evaluation of Vocational Industrial and Vocational Technical Schools and Programs."

At the other two meetings the "Functions and Responsibilities of Supervisory and Administrative Personnel for the Operation of Local Programs of Trade and Industrial Education," "Student Selection for Unit Trade Schools,"

(Continued on next page)

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(Continued from previous page)

and "Trade Competency Examinations," were discussed. Walter B. Jones, president of the association, and associate professor of education, University of Pennsylvania, Philadelphia, Pa., was chairman of both of the two last mentioned meetings.

At the business meeting the following were elected as officers for 1946:

President, S. Lewis Land; secretary-treasurer, Thomas Diamond, professor of industrial education, University of Michigan; vice-presidents, David Jackey, director of vocational teacher education, University of California, Merritt W. Haynes, teacher trainer for trade and industrial education for the state of Georgia, and Herb Heilig, teacher trainer in trade and industrial education, Colorado A. & M. College.

E. L. Williams, head of the department of industrial education, Texas A. & M. College, was elected for a three-year term on the board of trustees to succeed U. G. Whiffen, professor of industrial education, Washington State College.

The two trustees, whose terms carry over are Clyde A. Bowman, dean, division of industrial education, The Stout Institute, Menomonie, Wis., and G. Harold Silvius, assistant professor and supervisor of vocational education, Wayne University, Detroit, Mich.

Area vocational schools were discussed at numerous meetings, but the need of schools of this kind was quite commonly conceded in view of the fact that about 50 per cent of our students drop out of school between the eighth grade and the end of the twelfth grade.

It also was quite commonly accepted that there should be two-year vocational and technical courses beyond high school available for those who do not attend college.

At the opening session of the convention on Wednesday evening, M. D. Mobley, president, American Vocational Association, Inc., and state director of vocational education, State Department of Education, Atlanta, Ga., presided.

The subjects for discussion were "The Vocational Rehabuitation and Educational Program for Veterans," and "Area Vocational Schools."

The first of the industrial arts sectional meetings on Thursday morning, February 7, was presided over by Arthur B. Mays, professor of industrial education, College of Education, University of Illinois, Urbana, Ill.

G. Harold Silvius presented a very fine address on "Outstanding Teachers Activities."

At this meeting it was suggested that Frank C. Moore, A.V.A. vice-president for industrial arts and director of industrial arts, board of education, Cleveland, Ohio, appoint a committee of three on research in the field of industrial arts.

A panel led by Dr. H. H. London, associate professor of industrial education, University of Missouri, Columbia, Mo., then discussed the question "Should We Have a National Industrial Arts Program, and of What Should It Consist?"

Another question discussed was "Should Industrial Arts Be Subsidized With Federal Money?"

These questions produced a very lively discussion.

(To be continued)

♦ The Iowa Industrial Education Association convention was held at Des Moines, Iowa, on January 31 and February 1, 1946. It was opened with a Fellowship Dinner sponsored by the Twenty-Five Year Club in the cafeteria of the Des Moines Technical School. Roy C. Woolman, director of industrial education, Des Moines, presided.

Guests of honor were Dr. Homer J. Smith of the University of Minnesota, and A. L. Anderson of Fairfield, Iowa, one of the founders of the firm of Heston and Anderson of that town. James H. Brolliar, World War II veteran, well-known former industrial-arts instructor, read the following list of new members eligible for the Twenty-Five Year keys: R. L. Bergstrom, Davenport; Walter McMahan, Clinton; J. H. Gooch, Des Moines; V. W. Hahn, Ottumwa; Albert J. Jensen, Council Bluffs; Wm. K. Ketchen, Emmetsburg; C. E. McCaslin, Fort Madison; A. F. Wiegmann, Davenport; W. J. Knupp, Sioux City; Charles G. Turrall, Des Moines; Glen Osborn, Ottumwa; I. F. Mueller, Council Bluffs; John L. Morton, Des Moines; W. S. Morgenthaler, Des Moines; H. G. Palmer, Cedar Falls; Allen Sherman, Des Moines; Robert McKig, Davenport; C. G. Sykes, Newton; Jacob Roth, Cedar Rapids; Russell Starr, Waterloo; R. M. Hammes, Davenport.

I.I.E.A. twenty-five year key

Iowa men become eligible to receive the honor key after having served in the field of industrial education for 25 years, and the membership now totals 63. The key design is by R. M. Hammes of Davenport, Iowa, and the keys are presented through the courtesy of Heston and Anderson.

At the conclusion of the brief initiation ceremony, P. G. Frasier, principal of the Des Moines Technical School, spoke on the orientation program used at their school. Dan J. McQuaid of Denver, Colo., engineer, author, lecturer, and inventor, conducted an informal discussion of his experiments in mechanical drawing. Several professional engineers and architects were present to hear Mr. McQuaid.

At 10:00 a.m., the following day, a large group of instructors toured the shops of the Des Moines Technical School. Following the noon luncheon, R. T. Henning of Davenport, past president of I.I.E.A., reviewed association activities from 1941 to 1946.

Mr. McQuaid gave a lecture and demonstration of his new system of mechanical drawing, which he has named the "Air-Vu System," because it is essentially mechanical perspective with the viewpoint at infinity. Drawings can be made with special instruments or by the use of a drafting machine called the "Sun View Drafting Machine."

(Continued on page 26A)

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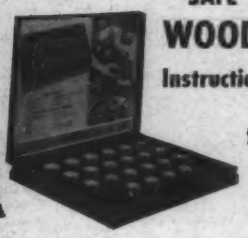

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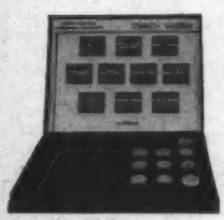

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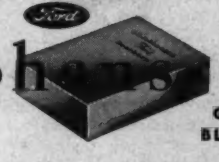

Johansson GAGE BLOCKS

(Continued from page 24A)

This is certainly something new in the field of mechanical drawing, and may revolutionize modern drafting room practice, especially in the field of illustration.

Dr. Homer J. Smith of the University of Minnesota, in his own inimitable way, spoke of the distinct areas covered by industrial arts and vocational industrial education, and then of the interests common to both.

Officers of the association for 1945–46 are: Earl Kimball, president, West High School, Waterloo, Iowa; Lawrence J. Swartz, vice-president, Junior High School, Marshalltown, Iowa; Richard R. Kyl, secretary-treasurer, 4323 Franklin St., Des Moines, Iowa. — *Earl Kimball.*

♦ The Mid-West Ohio Industrial Arts Association has again organized after three years of inactivity. Embracing 13 counties in the western section of Ohio, this group has a continually growing membership.

Professors D. R. Lowman, of Ohio Northern University, E. J. Crowley and E. C. Powell of Bowling Green State University, are members of the organization, and the monthly meetings are regularly attended by many school principals, superintendents, and board of education members who have become intensely interested in the program of activities carried on.

Milferd Hansen, industrial-arts head at Lima South High School, and recently returned research specialist at Princeton University where secret atomic research took place, was the featured speaker at the November meeting of the Mid-West group. This meeting was held in Lima.

Bowling Green State University officials were hosts at the January meeting. Opening with an elaborate banquet the industrial-arts teachers listened to a detailed explanation of the distribution of both excess and surplus war materials and equipment. Mr. Reese, former assistant state director of education and currently serving in an advisory capacity to the state department dealing in surplus distribution, was the principal speaker of the evening. Professor Crowley, printing instructor at the university, also spoke briefly relative to the development of printing instruction at the school. Crowley closed the meeting with a planographic demonstration.

The February meeting was again held in Lima and featured a conducted tour through the Lima Locomotive Works. Heavy machine work was observed throughout the entire plant and the research laboratory captured the interest of the entire group. Officials of the plant arranged a special treat for the group by holding up one assembly of a boiler on its chassis until all the industrial-arts group were present. This was one of a huge order being prepared for the French government. The Lima Works is the third largest in the world.

Credit for arranging the 1945–46 programs for the Mid-West Ohio Association is due Lewis Miller of Napoleon, who is serving as chairman of the program committee. Miller is being assisted by Professor Lowman of Ada, and Professor Crowley of Bowling Green. The program chairman has announced the March meeting would be held at Lima Shawnee High School and that the evening discussion subject would be *Plastics.*

The officers of the Mid-West Association are: president, Loren C. Van Meter; vice-president, Wade Schenk, Columbus Grove; and secretary-treasurer, H. F. Edgar of Wauseon. — *Arthur W. Croft.*

♦ The Newark Industrial Arts Teachers' Association, Newark, N. J., through its memorial committee, has planned the Allen D. Backus Memorial Section in the Newark Board of Education library. This will consist of an industrial-arts book section and a display cabinet in which current practices of industrial arts may be displayed in pictorial or project form.

♦ *March 25–30.* North Central Association of Colleges and Secondary Schools at Chicago, Ill. G. W. Rosenlöf, secretary, University of Nebraska, Lincoln, Neb. Headquarters, Palmer House.

♦ *March 28–29.* South Carolina Education Association at Columbia, S. C. J. P. Coates, secretary, 1510 Gervais St., Columbia, S. C.

♦ *March 27–30.* Schoolmen's Week at the University of Pennsylvania, Philadelphia, Pa. Theodore L. Reller, 3812 Walnut St., Philadelphia, Pa.

♦ *April 3–4.* Florida School Board Association at Tampa, Fla. James S. Richard, 6 Centennial Bldg., Tallahassee, Fla., secretary.

♦ *April 3–6.* Western Arts Association at St. Louis, Mo. Joseph K. Boltz, secretary, Franklin, Mich. Headquarters, Hotel Jefferson.

♦ *April 4–6.* Illinois Industrial Education Association at Chicago, Ill. Dr. Louis V. Newkirk, secretary, Board of Education, Chicago, Ill.

♦ *April 5–6.* Western Ohio Superintendents and Principals Round Table at Dayton, Ohio. A. E. Gower, Chillicothe, Ohio, secretary. Headquarters, Y.M.C.A.

♦ *April 9–13.* American Association for Health and Physical Education and Recreation at St. Louis, Mo. Dr. Ben W. Miller, 1201 16th St., N.W., Washington, D. C., secretary. Headquarters, Hotel Jefferson.

♦ *April 8–10.* Association for Childhood Education at Cincinnati, Ohio. Miss Mary E. Leeper, 1201 16th St., N.W., Washington, D. C., executive secretary. Headquarters, Gibson Hotel.

♦ *April 11.* Kentucky State School Board Association at Louisville, Ky. L. C. Meece, College of Education, University of Kentucky, Lexington, Ky., secretary. Headquarters, Brown Hotel.

♦ *April 11–13.* Michigan Industrial Education Association at Grand Rapids, Mich. Arthur L. Reagh, 143 Bostwick Ave., N.E., Grand Rapids, Mich., executive secretary. Headquarters, Pantlind Hotel.

♦ *April 12.* Northeastern Wisconsin Education Association at Fond du Lac, Wis. A. M. Bleyer, Vocational School, Oshkosh, Wis., secretary. Headquarters, Hotel Retlaw.

♦ *April 12–13.* Indiana Industrial Education Association at Indianapolis, Ind. H. G. McComb, state dir., Vocational Training for War Prison Workers, 215 State House, Indianapolis 4, Ind. Headquarters, Claypool Hotel.

♦ *April 15–18.* Association of School Business Officials at Pittsburgh, Pa. H. W. Cramblet, Board of Education, Pittsburgh, Pa., secretary.

♦ *April 17.* Missouri Association of School Boards at Jefferson City, Mo. Mrs. E. M. Flippen, State Dept. of Education, Jefferson City, Mo.

♦ *April 17–19.* Kentucky Education Association at Louisville, Ky. W. P. King, 1421 Heyburn Bldg., Louisville, Ky., secretary. Headquarters, Brown Hotel.

♦ *April 17–20.* Eastern Commercial Teachers Association at New York, N. Y. Bernard A. Shilt, City Hall, Buffalo 2, N. Y., secretary. Headquarters, Hotel New Yorker.

♦ *April 18–20.* Tennessee Education Association at Nashville, Tenn. F. E. Bass, 602 Cotton States Bldg., Nashville, Tenn., secretary. Headquarters, Auditorium and Jackson Hotel.

♦ *April 20.* Massachusetts Teachers Federation at Boston, Mass. Hugh Nixon, 14 Beacon St., Boston, Mass., secretary. Headquarters, Statler Hotel.

♦ *April 22–25.* American Association of Collegiate Registrars at Atlanta, Ga. R. F. Thomason, University of Tennessee, Knoxville, Tenn., secretary.

News Notes

♦ The Illinois Institute of Technology's Ohmite Laboratory, Chicago, Ill., will make its facilities available to sponsoring organizations beginning this month.

The result of a $32,000 contribution by David T. Siegel, president of the Ohmite Manufacturing Company, this laboratory will provide precision measurement of electrical and magnetic quantities for the Chicago area, approaching in accuracy those of the Bureau of Standards in Washington.

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(Continued on page 28A)

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(Continued from page 26A)

at Technology Center, the laboratory is jointly operated by Illinois Tech's electrical engineering department and the electrical engineering division of the Institute's Armour Research Foundation.

Under the direction of L. W. Matsch and Prof. E. H. Schulz, the Ohmite Laboratory will be the first laboratory of its kind with facilities in the Chicago area available to industry. It will also be used for graduate study and in electrical standardizing work for the various departments of the Institute.

♦ The Builders Association of Niagara Falls, local A.F.L. building trade-unions, and the Niagara Falls Vocational School are co-operating in the establishment of a new apprenticeship system.

The venture was launched by the indenture of 52 young men, most of whom are World War II veterans, as building trades apprentices.

The term of apprenticeship for most of the young men is 4 years, and the trades selected are bricklaying, carpentering, cement finishing, decorating, electrical work, plastering, plumbing, steam fitting, and tile setting.

♦ The Bamberger Chair of Merchandising was formally established on Wednesday, February 6, in the auditorium of Memorial Hall at Pratt Institute, Brooklyn, N. Y., when a check for $5,000 was presented to the Pratt Institute to finance seven full scholarships for the current year for students of The Art School, and also to maintain the Pratt-Bamberger project which includes plans for a lecture series and a research laboratory to be established at Bamberger's. The project will be under the co-operative guidance of Konrad F. Wittman, chairman of the department of interior design at The Art School, and Mrs. Clarice Young Morgan, who serves both as an instructor for Bamberger's in color and design, and as a member of the interior design faculty at Pratt.

♦ An official school savings charter will be issued to each school in the nation which enrolls in the permanent school savings program, set up in co-operation with the United States Treasury Department and the Office of Education. Signed by the Secretary of the Treasury and countersigned by the principal of the school, the charter will be a constant reminder of the school's enlistment in the program "to promote understanding of the personal and national reasons for continued saving and to give the opportunity to save regularly at school."

Any school which enrolls in this educational program of information and steady savings may secure its charter on request to its State Savings Bonds Office.

During the war years nearly 50,000 schools have dramatized their all-out participation in the War Savings Program by displaying the blue and white *Schools-at-War* flag when they could certify that at least 90 per cent of their students were saving regularly. Such a school may secure a *distinguished service* award in the form of a *Well Done* insigne to be sewed to the flag before it is enshrined in the trophy case of wartime mementoes. Application for the free flag insigne should be made to the State Savings Bonds Office.

♦ A vocational and educational guidance center for returning verterans has been set up in the Milwaukee Vocational School, Milwaukee, Wis.

The counseling and guidance work will be done by the school personnel.

♦ The fourth issue of the "Bibliography of Scientific and Industrial Reports Distributed by the Office of the Publication Board, of the Department of Commerce," containing abstracts of 473 reports, are now available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

The price of this fourth issue is 20 cents.

♦ A day trade printing course was started at the beginning of the second semester in Arkansas, Kans. One-half day is being devoted to a printing class on a prevocational level.

♦ Highland Park Rural High School, Highland Park, Topeka, Kans., has started a day trade auto-mechanics program. W. A. Simpson, garage owner and operator of Topeka, will be the instructor. The program will operate for one-half day daily on a trade basis. Twenty boys are enrolled.

♦ An interesting Evening Trade Extension class in machine shop has been formed in Joplin, Mo., for blind people. This class meets twice weekly for three hours in the evening and instruction is given to eight blind men in the use of hand tools and machines.

♦ R. T. MORRILL, Beloit, Wis., chairman of the apprenticeship committee of the National Master Plumbers' Association and of the special state association group on apprentices, told 150 members of the state association recently that approximately one third more plumbers than are now in the state will be needed in the immediate future.

This undoubtedly is true in other building trades and points out what a big problem is confronting vocational education in Wisconsin and elsewhere.

SURPLUS PROPERTY DIRECTORS

H. F. Alves, director of the division of Surplus Property Utilization in the U. S. Office of Education, has announced the executive officers or directors of state educational agencies and field representatives appointed in many states to assist eligible public and private educational claimants to obtain such available surplus property as they need and can effectively utilize. As of January 24 the governors of 38 states had responded to the request of Commissioner John W. Studebaker that they or the legislatures establish state education agencies on surplus property.

In most states the chief state school officer has been designated as the official to direct the program.

The officials appointed to aid in securing surplus property for education are given below. In states where the chief state school officer has been named as director he may be addressed at the state department of education. Addresses of other directors and of field representatives, the second name given for some states, are shown.

Alabama. State Superintendent E. B. Morton, Montgomery.

Arkansas. William H. Moore, director, Educational Agency for Surplus Property; Crawford Greene, both, State Department of Education, Little Rock.

Colorado. H. Rodney Anderson, State Purchasing Agent, State Capitol; Lloyd A. Garrison, State Department of Public Instruction, Room 205, Argenaut Hotel, 232 E. Colfax Ave., both Denver.

Connecticut. Commissioner Alonzo G. Graze; Virgil H. Barker, State Department of Education, Hartford.

Delaware. State Superintendent H. V. Holloway, Dover.

Florida. Walter E. Keyes, field representative, State Department of Education, Tallahassee.

Georgia. J. W. Sikes, director, Division of Surplus Property, 238 State Office Building; H. S. Burdette, Room 204, State Office Building, Atlanta.

Idaho. State Superintendent G. C. Sullivan, Boise.

Indiana. H. G. McComb, executive officer, Educational Agency for Surplus Property, Room 227, State House, Indianapolis.

Kansas. C. V. Kincaid, state business manager, State House, Topeka.

Kentucky. Gordie Young, Assistant State Superintendent; Harley E. Talley, State Capitol, Frankfort.

Louisiana. C. E. Laborde, executive officer, Educational Agency for Surplus Property; M. S. Robertson, both State Department of Education, Baton Rouge.

Maine. Commissioner Harry V. Gilson; William O. Bailey, State Department of Education, Augusta.

Maryland. State Superintendent T. G. Pullen, Jr., 1111 Lexington Building, Baltimore.

Massachusetts. Commissioner Julius E. Warren, Boston.

Michigan. State Superintendent Eugene B. Elliott; James D. MacConnell, 600 Bauch Building, Lansing.

Minnesota. Commissioner Dean M. Schweickhard, St. Paul.

Mississippi. W. D. Hilton, Director of Office of Surplus Property; Knox M. Broom, Box 45, Jackson.

(Continued on page 31A)

SHOP BOOKS

★ Aeronautical Instrument Projects

This book provides simplified, practical information about the many instruments essential to successful aviation, with instructions for building these instruments to enable the student to fully understand their use and operation. A few radio and weather instruments are included. 25 projects. 124pp4. $1.20. *Weber.*

★ Applied Fundamentals of Machines

Text, laboratory manual and notebook combined. Gives essential theories, experiments, demonstrations. Assigament units instruct students in the proper procedure for each job encountered. 320 pps. $2.50. *Cornstet & Fox.*

★ Gas & AC Arc Welding

A manual on both Gas & A. C. Arc Welding and Cutting written for beginners. Exercises and projects arranged in their order of difficulty and have been selected to provide necessary learning experiences at a nominal cost of materials. Suggested list of equipment and supplies for the average general metal shop to do welding of steel, wrought iron, malleable iron, cast iron, copper and the like. Illustrated. 84 pps. *.96 Jennings.*

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Direct-drive 3600 r.p.m. motor. Precision key chuck—½" capacity. Bushings available for chisels and bits up to 1" square. Positive accuracy and alignment insured with table and motor operating on same ways. Boring attachment extra.

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Correspondence concerning undergraduate work and graduate patterns may be addressed to the Department of Industrial Education, 200 Eddy Hall.

The Dean of the Graduate School, 234 Administration Building, will supply a Bulletin of General Announcement and a blank of "Application for Admission."

Bulletins of the Summer Session may be obtained from the Director of Summer Session, 773 Administration Building.

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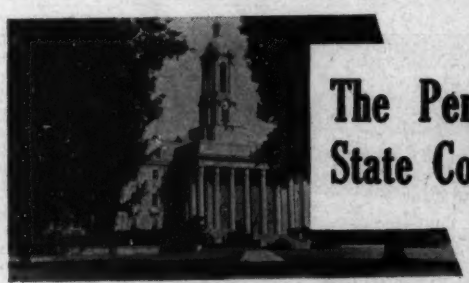

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History of manual and industrial education, construction and uses of visual aids, written and graphic aids, trade and occupational analysis, philosophy of vocational education, planning vocational courses, organizing regional vocational education, vocational guidance and counseling, seminars, special studies, graduate thesis. Full programs in education, science, home economics, general subjects.

Formal study in scenic surroundings, with the Pacific beaches two hours away and with week-end trips to the Cascade Mountains, Crater Lake, Oregon Caves, Cascade Lava Beds, and the Columbia River Highway.

- STAFF *of famous instructors, both visiting and resident. Spendid physical plant.*
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For Special Summer Bulletin write to

Department of Industrial Education

OREGON STATE COLLEGE

CORVALLIS, OREGON

Authorized by State Board of Education

(Continued from page 28A)

Missouri. State Superintendent Roy Scantlin; Tracy E. Dale, State Department of Education, Jefferson City.

Montana. State Superintendent Elizabeth Ireland; Ira B. Fee, State Department of Public Instruction, Helena.

Nebraska. Field Representative O. H. Dimson, 2741 N. 50th St., Lincoln.

New Hampshire. Acting Commissioner Walter M. May, Concord.

New Mexico. R. H. Grissom, educational budget officer, State Department of Education; William R. Skipping, P. O. Box 1157, Santa Fe.

North Carolina. W. Z. Betts, director, Division of Purchase and Contract; A. W. Honeycutt, State Department of Education, Raleigh.

North Dakota. A. F. Arnason, Commissioner of Higher Education, Bismarck.

Ohio. State Superintendent Clyde Hissong; Lloyd W. Reese, State Department of Education, Columbus.

Oklahoma. Joe R. Holmes, Surplus Property Agent, State Capitol; Floyd A. Ramsey, 218 Northwest 32nd St., Oklahoma City.

Oregon. State Superintendent Rex Putnam; Paul T. Jackson, State Department of Education, Salem.

Pennsylvania. State Superintendent Francis B. Haas; Donald P. Davis, State Department of Public Instruction, Harrisburg.

South Carolina. State Superintendent James H. Hope, Columbia.

South Dakota. A. B. Blake, Secretary of Finance, Pierre.

Tennessee. Harvey T. Marshall, director, Educational Agency for Surplus Property, State Department of Education, Nashville.

Texas. Weaver H. Baker, chairman, Educational Agency for Surplus Property, State Board of Control; J. Fred Horn, P. O. Box 2142, Capitol Station, Austin.

Utah. J. Easton Parratt, Educational Agency for Surplus Property; Fred M. Fowler, State Department of Public Instruction, Salt Lake City.

Vermont. Deputy Commissioner Carl J. Batchelder; Winn L. Taplin, State Department of Education, Montpelier.

Virginia. Linscott Ballentine, Assistant Supervisor, Trade and Industrial Education; Davis Y. Paschall, State Department of Education, Richmond.

Washington. State Superintendent Pearl A. Wanamaker; B. F. Minor, State Department of Public Instruction, Olympia.

West Virginia. Carl Riggs, executive officer, Educational Agency for Surplus Property, 422 Capitol Building, Charleston.

Wisconsin. J. H. Armstrong, executive officer, Educational Agency for Surplus Property; Walter B. Senty, State Department of Public Instruction, Madison.

Educators are hopeful that the setting up of this organization will assist school systems and institutions to secure needed property. One criticism has been that such property is moving too slowly. Another is that those whose need is greatest are not receiving even a proportionate share. School departments and institutions with well-functioning business staffs and ample budgets have been able to act quickly and thereby speedily move equipment and supplies as soon as they have been declared surplus.

♦ The sum of $50,000 has been allocated to the New York State Education Department for making the research surveys required by the development of curriculums in vocational subjects for the post-high school institutes of applied arts and sciences to be established by the Board of Regents.

Dr. C. Kenneth Beach will direct this work.

New Publications

Wings Over America

By John Stuart. Paper cover, 32 pp., 5⅜ by 8⅜ in., 10 cents. Published by the Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

The author, who is an aviation reporter and a specialist in the field of airplane use for military and peacetime purposes, analyzes in an understandable way, what the airplane meant to us during the war, and what it can mean to us in the future if we make proper use of it.

Mr. Stuart expresses the fear that the production of military and civilian planes may be much lower than is currently expected, and that this will react unfavorably against the maintenance of an aircraft industry sufficiently large for national security.

Basic Mechanical Drawing

Glenn N. Shaeffer. Paper cover, 88 pp., 6⅞ by 10¼ in., 60 cents. The Bruce Publishing Co., 540 North Milwauke St., Milwaukee 1, Wis.

A text for beginners which presents a large number of simple problems to the beginner. In this way the student develops skills and understanding of the subject matter in the easiest and quickest way.

The material is divided into nine chapters which cover lettering, drawings containing horizontal and vertical lines, hidden lines, inclined lines, circles and arcs, tangents, irregular curves, size description and making tracings for blueprints.

Colonial Lanterns

By Louis J. Haas. Paper cover, 8 plates, 7 by 9¾ in., 70 cents. Published by Louis J. Haas, 3 Gedney Terrace, White Plains, N. Y.

Eight plates of lantern designs illustrated in the author's inimitable way. These lanterns may be made of any sheet metal that is available. If necessary, tin cans can be used.

The plates show how to do every part of the job and the directions are easily followed.

Plastics Mold Engineering

By J. H. DuBois and W. I. Pribble. Cloth, 494 pp., 5¾ by 8½ in. Published by American Technical Society, Chicago, Ill.

A very comprehensive book on the designing

(Continued on page 36A)

SEE THE PRETTY BIRDIE!

So Easy to Whittle with an X-acto Knife

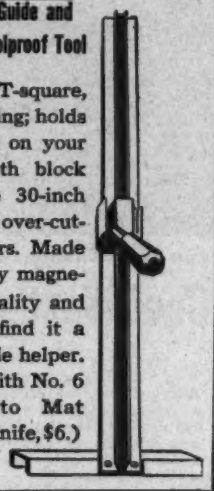
No trouble to make, no trouble to keep . . . that's the double feature of this little yellow-bill. Carve it out of a hunk of soft white pine in a jiffy, with your super-sharp X-acto. It's one of 25 clever projects in the fascinating 32-page booklet, "Whittling Is Easy With X-acto." Send 10c for a copy.

A Blade for Every Cutting Job

Here's the whittler's delight . . . an all-metal X-acto Knife, with special assortment of whittling blades. Firm-grip handle, designed for safety and precise control. Ideal for curves and corners. Complete with wooden chest, $2. Other X-acto Knives and Sets, 50c to $5.

CUT PERFECT MATS

New X-acto Knife Guide and Beveler Is Simple, Foolproof Tool



Designed like a T-square, with non-slip ridging; holds firm and straight on your work. The smooth block slide and visible 30-inch scale help prevent over-cutting at the corners. Made of light but sturdy magnesium. Tops in quality and accuracy. You'll find it a mighty handy little helper. $7.50 complete with No. 6 All-Metal X-acto Mat Knife. (Without Knife, $6.)

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Shop Equipment News

New Products—Publications

PORTABLE 12-INCH RADIAL SAW

A new lightweight portable 12-inch radial saw has just been added to the Monarch Uni-Point line of woodworking machinery.

The new radial saw is made principally of light, nonrusting magnesium, so that the unit complete with carrying frame and 1½ hp. electric motor weighs approximately 200 pounds. It is so compact that it is easily carried through a 30-inch doorway, yet it has a 3 by 16-inch crosscut and 20½-inch wide ripping capacity, and it will handle all the different kinds of work that heavy stationary radial saws will do.

The American Saw Mill Machinery Co., Hackettstown, N. J., will furnish more specific data about this useful portable saw to anyone writing for it.

For brief reference use IAVE—1310.

Portable radial saw

NEW CINCINNATI PLAIN HYDRAULIC GRINDING MACHINES

A line of four precision center-type plain grinding machines has been announced by Cincinnati Grinders, Inc. These are the 6-in., 10-in. *L*, 10-in and 14-in. *L*. The two sizes followed by letter *L* are light types, having all the characteristics and built in the same lengths as the sizes immediately preceding them, but having the extra swing capacity to accommodate a flange or projecting arm on the work.

6 by 30-in. plain hydraulic grinding machine

The same features are incorporated in all four sizes. Grinding wheel spindles run on Filmatic bearings. Filtered oil under a light pressure is circulated to the bearing compartment. As the spindle rotates it draws oil under segments which pivot slightly, creating a high pressure wedge shaped oil film between each segment and the spindle. These self-renewing high pressure oil wedges maintain exact dead-center rotation. Tables are traversed hydraulically by an externally mounted motor driven pump unit.

Table traverse rates may be infinitely varied from 3 in. per minute to more than 200 in. per minute. A single lever control starts and stops the table traverse and coolant flow. Length of table traverse may be automatically dog controlled from the full rated stroke to as short as 3/32 in.

Other items of operation and control are completely covered in a catalog which may be obtained by writing to Cincinnati Grinders, Inc., Cincinnati 9, Ohio.

For brief reference use IAVE—1311.

BLACKSMITH BUFFER AND GRINDER

This low pedestal type buffer and grinder was designed especially for use in blacksmith shops for the grinding and buffing of plow shares, and other long, odd-shaped pieces. It is also adaptable to a wide variety of other shops and the hundreds of buffing and grinding jobs they have to do.

There is over 40 in. of working space between the wheels and the low design of the pedestal. This enables the worker to sit at the work and brace the workpiece between his protected knee and the buffing wheel, assuring him of enough pressure against the buffing wheel to produce a very smooth finish.

The grinders are fabricated from steel sheets rolled and electrically welded, insuring light weight yet sturdy construction. The ball bearings and smooth operating, long-life nonstalling motor are fully enclosed. The strong, durable

(Continued on page 35A)

The INK that came to Dinner!

When artist Wallace Morgan portrayed the Cratchit family's unforgettable Christmas Dinner in Dickens' "A Christmas Carol," he naturally turned to Higgins American India Ink as his medium — for, like countless other noted artists and designers, Wallace Morgan relies on Higgins American Drawing Inks for their distinguished simplicity of line, their controlled accuracy and facility of use. You too will find that Higgins Inks are unsurpassed for excellence.

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require actual experience to really learn all phases of their chosen trade. Producing the school's envelope needs is an excellent method to acquire that experience and knowledge . . . as well as solving many of the school's printing problems.

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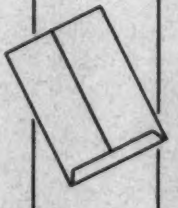

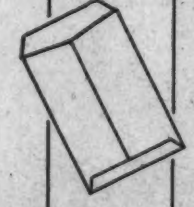

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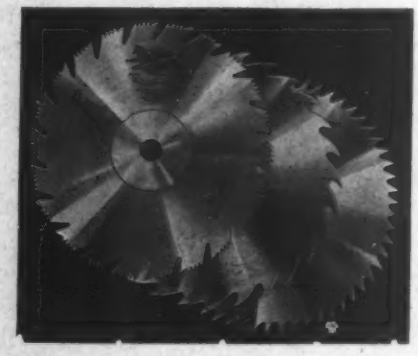

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OHLEN-BISHOP Circular Saws are proving their quality and stamina in stepping up war production. They'll do the same in your shop. Special quality steels, made to our own time tested formula, perfectly tempered, assure low maintenance cost — less time out for sharpening. Proven designs stand up longer, cut faster and truer. More than a dozen different styles of teeth — complete range for every machine.

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OHLEN-BISHOP SAWS

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If you desire to save time and die expense on production of metal stampings or other small parts, then the DI-ACRO System of "Metal duplicating Without Dies" merits your consideration. It is based on the rapid and accurate production of formed parts with DI-ACRO Shears, Brakes and Benders. All duplicated work is accurate to .001". These precision machines are adaptable to an endless variety of work, and ideally suited for use by girl operators. For short runs your parts are processed in a matter of hours instead of waiting weeks for dies.

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It illustrates many stampings or parts made without dies, gives full details on DI-ACRO machines and shows how they may readily be adapted for various applications. Request your copy now.

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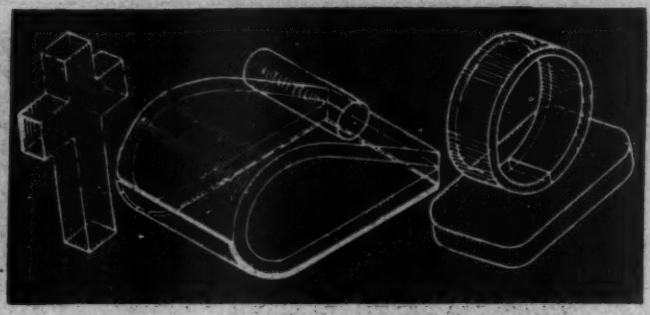

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How your students will enjoy working with plastics! Crystal-clear, easily carved, cut and shaped, plastics will enable them to produce finished products of true professional appearance, that will bring exclamations of admiration from friends and parents.

We can supply you with Plexiglas, Lucite, Bakelite, Tenite II, Lumarith, Lignolite, and other plastics in sheets, rods and tubes especially suited for the school workshop. Also available are project plans and complete fabricating information.

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Teach Soldering The Easy Way with Rubyfluid Flux

Rubyfluid Paste and Liquid Soldering Flux is easier for the student to use. It wets out freely and properly prepares metal to give solder a firm hold—produces strong neat unions every time. Will not corrode metal—has no harmful or objectionable fumes.

Rubyfluid also has a special flux for stainless steel, that requires no extra equipment or excessive heat. Will not discolor metal.

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Your students should be provided with *BAND SAW BLADES* which have been adopted as being able to stand the stiff requirements of War Production Plants.

Accurately made Band Saws of extreme toughness enables more work to be produced in less man hours.

All sizes are carried in stock for prompt shipment.

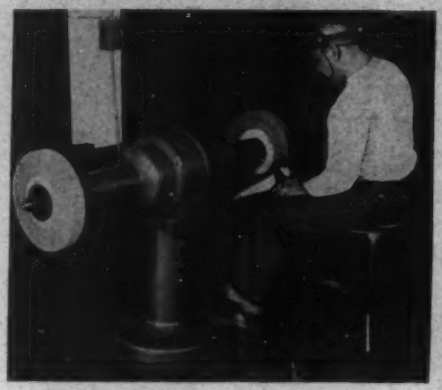
Exclusive Band Saw Manufacturers.

PARAMOUNT SWEDISH BANDS
ACCURATELY SPACED TEETH
NO CRUSHED POINTS - GUARANTEED

BURRILL SAW & TOOL WORKS
ILION, N. Y.

(Continued from page 32A)

shaft and motor are perfectly balanced and ride on three heavy duty ball bearings with a minimum of vibration.



Blacksmith buffer and grinder

The 3 horsepower motors are repulsion-induction if single phase, or squirrel cage induction if three phase. They use current only in proportion to the load and are a nonstalling type that will not slow down under rated load. They operate at the safe, long-life speed of 1750 r.p.m.

The starting switch is conveniently located on the pedestal, just under the motor where it is within easy reach of the operator's hand or knee.

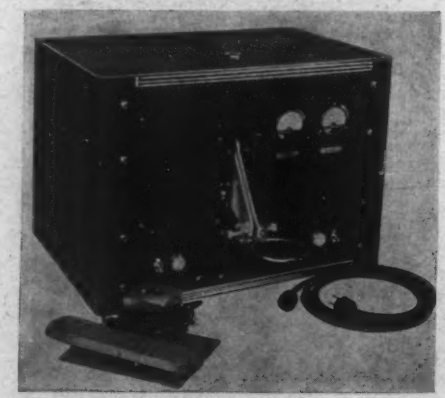
For further information, address The Hobart Brothers Co., Hobart Square, Troy, Ohio.

For brief reference use IAVE—1312.

MARION, LOW-COST INDUCTION HEATER

The Marion Portable bench-type induction heater, produced by the Marion Electrical Instrument Co., of Manchester, N. H., was developed to meet the need for clean soldering of small parts, and for soldering of metal to metalized glass and ceramics.

The production model now available features improvements in design, operating efficiency, safety, and simplicity of application. The circuit design is such that the operation of the heater offers less hazard than a soldering iron, and yet it does a neater, cleaner, and faster job. Even an inexperienced workman can quickly learn how to operate it efficiently. The coupling link, operating at low impedance, is provided with a



Marion low-cost induction heater

grounded center tap. The frequency, 450 kilocycles, produces no harmful radiations, and the unit is completely shielded for safety and to meet FCC requirements with reference to radio interference.

Two switches constitute the controls. No tuning control is needed or used. One of the switches controls the power to the tube filaments, and constitutes a standby switch. In this condition, the heater consumes only 100 watts. The other switch, also mounted on the panel, is the operating switch and controls the high voltages to the tubes. Provision has been made to operate this switch circuit by foot treadle when desired.

For more details write to the Marion Electrical Instrument Co., Manchester, N. H.

For brief reference use IAVE—1313.

SLIDE RULE IN PLASTIC

Precision in plastic now becomes a reality with the 10-in. Universal Slide Rule ready for production by The Frederick Post Company. Plas-Ten is the name of this snow-white professional grade instrument with razor sharp, easy to read graduations. Its precision, smoothness of operation, quick and easy adjustment will make the Plas-Ten the preferred rule of professionals.

The rule comes in a sturdy genuine heavy leather case. While there is but a limited number of the Plas-Ten now available, increasing production is anticipated.

For further information, address The Frederick Post Co., Box 803, Chicago 90, Ill.

For brief reference use IAVE—1314.

"I've got a good job in the best cabinet shop in town"

I really appreciated Jim's letter, because it's a satisfaction to see practical school shop training "pay off" in real life.

That's one reason I always use Weldwood Glue in my classes. It helps any woodworker turn out a better job.

And it makes my teaching easier. Weldwood Glue comes in fine powder form . . . mixes quickly with cold tap water . . . spreads smoothly and easily. I mix only what I need, and there's no mess or waste.

I get more work out of my classes, too, because Weldwood Glue sets so quickly . . . Jobs can be light-worked a few hours after clamping. And joints made with this modern, plastic resin glue are stronger than the wood itself. • • • •

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For full information and sample, mail the coupon today.

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This new calculating device consists of a round dial with three concentric celluloid printed disks. It eliminates the tedious figuring, usually necessary to determine the correct amount of radiation, and can successfully and easily be used by any one without previous technical training as its operation is rapid, not involving subtractions, divisions, complicated multiplication, nor the use of a formula. Just the simple turning of a dial and the correct answer is received.

The dials also contain sizes of mains, returns, risers, radiator sizes and capacities, round and sectional boiler ratings, chimney flue sizes and

(Continued on next page)

The first small portable tool and today's finest for work on metal, alloy, plastic, wood, horn, bone, glass, etc. Fits student's hand comfortably, perfectly balanced, weighs only 12 oz. Handee's usefulness is as extensive as the number of quick and easy-to-change accessories you have . . . choose from more than 300 in the Chicago line. AC or DC. 25,000 r.p.m. With 7 accessories, postpaid $18.50

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WEST COAST Mail Order and Retail
915 So. Grand Ave., Los Angeles, Calif.

(Continued from previous page)

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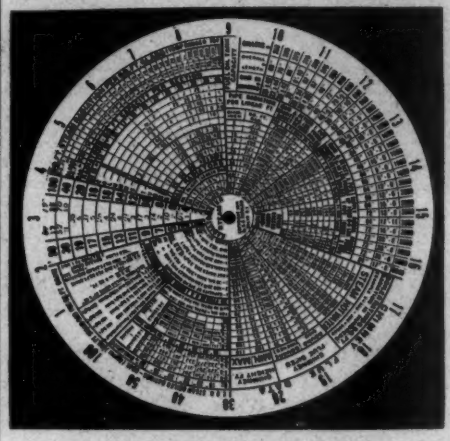

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abling plumbers, steamfitters, architects, builders, oil burner and heating salesmen, and all individuals who come in contact with heating problems to have the correct answers at their finger tips.

For brief reference use IAVE—1315.

A NEW SERVICE

The Behr-Manning Corporation, Troy, N. Y., have just issued an 8-page booklet informing the users of abrasives that henceforth branch office demonstration laboratories will be available for customers to pretest abrasive methods and equipment before applying them in their own plants.

Laboratories of this kind are now open at St. Louis, Chicago, Boston, Detroit, Cleveland, and at the home plant at Troy, N. Y. The same type of demonstration rooms will be opened later at Philadelphia, High Point, Los Angeles, New York, and Cincinnati.

For brief reference use IAVE—1316.

INDUSTRIAL ARTS AND OCCUPATIONAL THERAPY CATALOG

A complete catalog of materials for basketmaking; weaving; looms, and materials and accessories; bookbinding materials and equipment; artist's colors and brushes; linoleum blocks and cutting tools; modeling; stenciling; metalcraft; leathercraft; cork craft; and paper craft.

For a copy of this very complete catalog, address J. L. Hammett Co., Cambridge, Mass.

For brief reference use IAVE—1317.

ARTHUR H. STARRETT ELECTED PRESIDENT

Arthur H. Starrett was elected president of the L. S. Starrett Co., internationally known tool manufacturing organization, on January 25, 1946.

Mr. Starrett, of the third generation, started with the company in 1902, was appointed master mechanic in 1920, made a director in 1922, and vice-president in 1939. He is on the executive committee of the Associated Industries of Massachusetts and the National Metal Trades Association.

David Findlay, president of the company for the past seven years, has retired after 55 years of service. Starting on the road in 1891 and doing much of the pioneer work of introducing Starrett tools to both the shops and the trade, he became general sales manager in 1900 and served later as director and vice-president. Like Mr. Starrett, he personally witnessed and had much to do with the growth of the business from small beginnings to its present position as one of the largest and best-known producers of precision tools.

William J. Greene, vice-president in charge of sales since 1941, has been elected vice-president and director of sales. Mr. Greene has likewise been long associated with the company, first as shop demonstrator in 1914, then successively as sales

A. H. Starrett

representative, New York branch manager, eastern sales manager, general sales manager, and vice-president.

PUBLICATIONS

(Continued from page 31A)

of molds for producing plastic products. The book is well illustrated and the descriptions are clear.

The molding methods with relation to molding materials are discussed, as are also plastic product design, mold types, toolmaking equipment and methods, materials required to make molds, compression molds, transfer molds, injection molds, cold molds, extrusion molds, special fixtures, and mold maintenance and repair.

Teaching With Films

By George H. Fern and Eldon Robbins. Cloth, 146 pp., 5¼ by 7½ in., illustrated, $1.75. The Bruce Publishing Co., 540 North Milwaukee St., Milwaukee 1, Wis.

A textbook designed to help teachers make the most effective use of films for instruction. The problems discussed in the book are when and why instructional films should be used, principles for selecting good films, information on how to operate film projection equipment, projection conditions, acoustics, ventilation, seating arrangement, maintenance of equipment, and techniques of teaching with instructional films.

The authors, both of whom have had long experience in the fields of education, teacher training, and use of instructional films, have written this book largely for in-service teacher training. They have made no attempt to present an exhaustive study of audio-visual aids, but rather to present in simple terms and with generous use of illustrations the essential information that is most applicable to the teaching situation.

Books For You

Paper, 154 pp., 5⅞ by 8¾ in. Price, 30 cents. Published by The National Council of Teachers of English, 211 West 68th St., Chicago 21, Ill.

Prepared by the committee on book lists for junior and senior high schools, this booklet contains thousands of titles on many subjects which will entice the avid as well as the tardy reader of high-school age.

Rehabilitation of the Disabled Serviceman

This is a selected bibliography. Russell Sage Foundation, 130 East 22nd St., New York 10, N. Y. Price, 10 cents.

Toward Community Understanding

By Gordon W. Blackwell. American Council on Education, Washington, D. C. Price, 75 cents.

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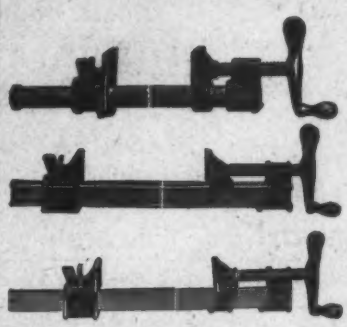

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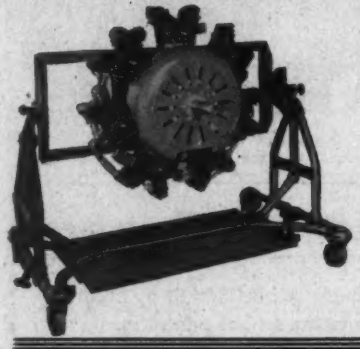

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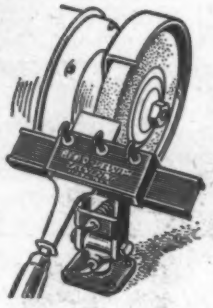

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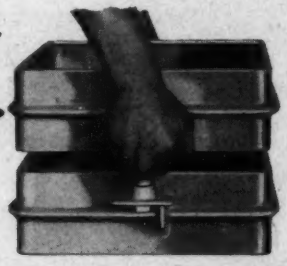

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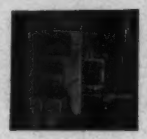

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433	434	435	436	437	438	439	440	441	442	443	444
445	446	447	448	449	450	451	452	453	454	455	456
457	458	459	460	461	462	463	464	465	466	467	468
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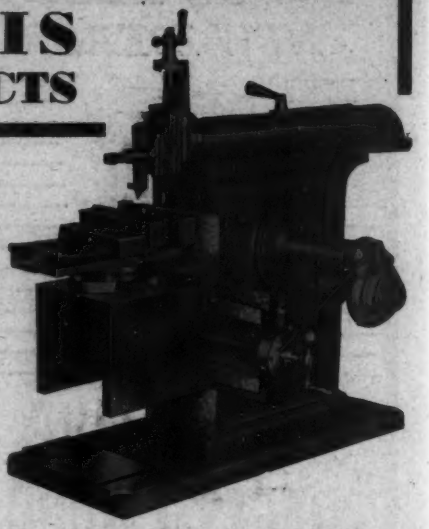

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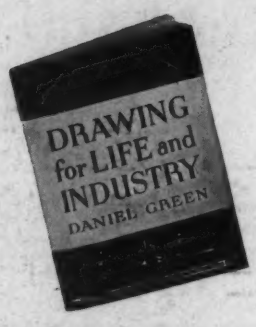

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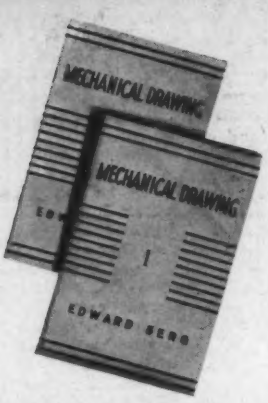

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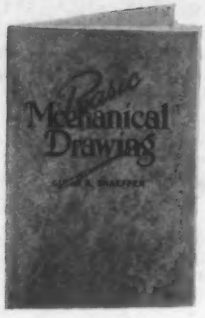

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